ANNUAL REPORT

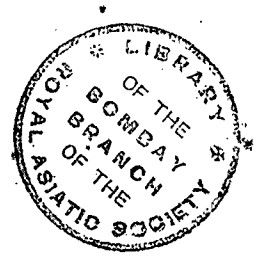
OF THE

DEPARTMENT OF AGRICULTURE,

BOMBAY PRESIDENCY,

FOR THE YEAR

1912-1913.



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From

W. W. SMART, Esq., B.A., I.C.S.,
Acting Director of Agriculture, Bombay,
Poona;

To

The CHIEF SECRETARY to GOVERNMENT,
Revenue Department, Bombay.

Poona, 20th October 1913.

Sir,

I have the honour to submit the Annual Report of the Agricultural Department for the year ending 30th June 1913.

CHAPTER I.

Administration.

2. I acted as Director of Agriculture throughout the year. The other posts held by Gazetted Officers were as follows :—

Not connected with the Agricultural College.	Connected with the Agricultural College.
1. Mr. T. F. Main, Deputy Director of Agriculture, Bombay Presidency	1. Dr. H. H. Mann, Principal, Agricultural College and Agricultural Chemist.
2. „ G. S. Henderson, Deputy Director of Agriculture in Sind.	2. Mr. J. B. Knight, Professor of Agriculture.
3. „ A. A. Musto, Agricultural Engineer.	3. „ W. Burns, Economic Botanist.
4. „ T. Gilbert, Assistant to the Deputy Director of Agriculture, in charge Southern Division, Dhárwár.	4. Ráo Sáheb G. K. Kelkar, Assistant Professor of Agriculture.
5. „ B. M. Desai, Divisional Inspector of Agriculture, Northern Division.	5. Mr. H. M. Chibber, Assistant Professor of Botany.
6. „ K. T. Shinde, Divisional Inspector of Agriculture, Central Division.	6. „ S. L. Ajrekar, Assistant Professor of Mycology.
7. Ráo Sáheb M. L. Kulkarni, Divisional Inspector of Agriculture, Southern Division.	7. „ S. S. Godbole, Assistant Professor of Physics and Mathematics.
8. Mr. V. H. Gonehalli, Divisional Inspector of Agriculture, for Konkan.	

A considerable number of changes took place during the year. Mr. G. S. Henderson went on leave and was succeeded by Mr. Gul Mahomed from 17th April 1913. The latter officer was made Divisional Inspector of Agriculture in Sind instead of Inspector of Experiments from 1st April 1913. Mr. A. A. Musto returned to the Public Works Department from 7th November 1912 and Mr. G. H. Thiselton-Dyer, Mechanical Engineer to the Government of Bombay, held the appointment of Agricultural Engineer in addition to his own duties

until he was relieved by Mr. W. M. Schutte on 24th January 1913. Mr. Schutte was selected by the Secretary of State for India for the appointment of Agricultural Engineer, which has been made permanent. He has taken up the work with enthusiasm and has initiated many improvements. Mr. P. C. Patil returned from his deputation to Europe and relieved Mr. Shinde on 26th November 1912. The re-distribution of charges referred to in last year's report was carried into effect from 1st October 1912. Mr. Gilbert, with the title of Assistant to the Deputy Director of Agriculture, Southern Division, relieved Mr. Main entirely of Belgaum, Dhárwár and Bijápur Districts, and in addition was put in charge of Sholápur and Sátára Districts, which had been in charge of Professor Knight. Mr. Gilbert has acquired a fair knowledge of the agricultural conditions of all the districts in his charge and of the Kánarese language, an examination in which he passed after the close of the year.

The remaining districts which had been under Professor Knight's administration, namely, Poona, Ahmednagar and Násik, were placed under Mr. Main. Mr. V. H. Gonehalli was appointed as Extra Deputy Director of Agriculture, Konkan, and placed in independent charge of Thána, Kolába, Ratnágiri and Kánara Districts, which previously had formed part of Mr. Main's unwieldy charge. Since the appointment of Mr. Gonehalli as Extra Deputy Director of Agriculture, the post of Divisional Inspector of Agriculture, Konkan, has remained in abeyance. From 1st October 1912 the districts under the Divisional Inspectors have been allotted as follows:—

Mr. Main's charge—

to Mr. B. M. Desai, Divisional Inspector of Agriculture, Northern Division, Surat, Broach, Kaira, Ahmedabad and Panch Maháls.

to Mr. P. C. Patil, Divisional Inspector of Agriculture, Central Division, Násik, Poona, Ahmednagar, East and West Khándesh.

Mr. Gilbert's charge—

to Ráo Sáheb M. L. Kulkarni, Divisional Inspector of Agriculture, Southern Division, Dhárwár, Belgaum, Bijápur.

to Mr. D. H. Tagare, a Senior L.Ag. of the Department, Sholápur and Sátára.

The number of districts in charge of Mr. Main and Mr. P. C. Patil is large and proposals will be submitted shortly for the transfer of Ahmednagar District to Mr. Gilbert and Mr. Tagare and the creation of a fourth appointment of Divisional Inspector of Agriculture in the Presidency proper.

3. Several changes took place during the year in the staff of the Agricultural College. Dr. Mann took privilege leave from 29th March to 30th May 1913, during which period Mr. W. Burns acted as Principal in addition to his own duties. Ráo Sáheb Kelkar, Assistant Professor of Agriculture, went on leave from the end of November 1912 and was succeeded by Mr. G. K. Ranade, Superintendent, Dhárwár Experimental Station. Mr. H. M. Chibber, Assistant Professor of Botany, was appointed to act as Professor of Botany at the Gujarát College, Ahmedabad, from February 1913, and his place was taken by Mr. G. B. Patwardhan, Superintendent, Ganeshkhind Botanical Gardens.

Professor J. B. Knight was relieved of the charge of five Deccan districts from 1st October 1912, but retained the direction of the Mánjri and College farms and the Government Civil Dairy.

4. The re-distribution of charges and the relief given to the Professor of Agriculture by the division of the five Deccan districts under him between Messrs. Main and Gilbert, have been productive of an enormous improvement in the general administration of the Department. Every officer now possesses a charge of reasonable size and accessibility, and Professor Knight has been able to devote proper attention to teaching at the College and to the farms remaining under his direction. He has been able to bring to a successful conclusion experiments conducted for many years on sugarcane cultivation, the manufacture of raw sugar, the improvement of indigenous implements, and problems connected with the "ráb" system of growing rice.

Those who attended the demonstrations at Mánjri and the College Farm at the time of the Conference held in September were struck with the admirable condition of both farms and with the number of useful and practical improvements demonstrated.

I attribute the great expansion of our activities in almost every district of the Presidency, which has taken place during the year, to the greater time and attention which the Deputy Director of Agriculture and other district officers have been able to devote to experimental and demonstrational work.

It is hoped that Mr. Gilbert's appointment will be made permanent shortly.

5. Since 1st April 1912 an advance of Rs. 40,000 was placed at the disposal of the Director for the purchase of seed and implements for sale to cultivators, for boring operations and other purposes. The new system has proved of immense benefit to cultivators to whom an enormous quantity of seed has been distributed in the course of the year. Formerly all such purchases were met from budget grants and the recoveries were credited to Government, and consequently the funds at the disposal of the Director were limited and delay occurred. To give some idea of the magnitude of the work of seed distribution and the readiness with which demands can be met, I may say that 132,725 lbs. of different kinds of seed were distributed in the charge of the Divisional Inspector of Agriculture, Southern Division, alone and that a demand for ammonium sulphate costing Rs. 5,365, which had to be imported from England, was satisfied within a period of about four weeks. The total amount advanced and recovered from my personal ledger account during the year for different purposes has been :—

	Seed.	Manure.	Implements.	Boring.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.
Advanced	22,520	...	2,978	2,778	28,276
Recovered	13,568	...	1,540	...	15,108

The system has added to the work of officers of the Department, and I would mention particularly the energy and ability displayed in the matter by Ráo Sáheb Kulkarni and Mr. B. M. Desai, Divisional Inspectors of Agriculture.

Moreover distribution work has been placed on much more business-like lines. The amount debited to the budget allotment provided to cover losses amounted only to Rs. 2,294 in all on 31st March 1913.

6. During the year under report the Lárkána and Lándhi experimental stations in Sind have been laid out and put in working order. In the Konkan the Alibág farm buildings have been started and the land for the new Ratnágiri experimental station has been taken on lease. Near Jalgaon 200 acres of land have been acquired for a seed farm for growing a selected variety of Roseum cotton for distribution of the seed to registered growers. The system of seed distribution which is to be introduced throughout Khándesh, where 1,300,000 acres are sown annually with cotton, has been based upon that in force in the Central Provinces. It is hoped that within a few years the organisation of the cotton seed supply of Khándesh will be established with immense benefit to agriculture and the trade.

7. Considerable additions have been made to the district staff. District Agricultural Overseers have been appointed for every district in the Presidency and Sind except six and in three districts there are two overseers. Of these overseers 15 are graduates and 9 non-graduates, and all work under the immediate supervision of the four Divisional Inspectors of Agriculture and Mr. Tagare, or the Extra Deputy Director of Agriculture in the case of the Konkan.

The establishment of new experimental stations has led also to an increase in the subordinate staff.

It has been found possible to issue orders to the district and farm staffs to carry out crop experiments, and it is hoped that in the course of time

valuable information will be collected as to the outturn of different crops, not only on our farms but in cultivators' fields. The same staff also have been directed to collect information on definite points of the rural economy of their districts. There can be no excuse in future for subordinate officers neglecting to observe and acquaint themselves with the agricultural conditions of their charges, and the superior officers of the Department have been requested to pay particular attention to these points, and to satisfy themselves by personal enquiry and otherwise that the subordinate officers are not performing routine duties with their eyes shut. I have noticed a considerable improvement during the course of the year in the amount of interest displayed by many subordinate officers in matters outside their routine duties. Many interesting contributions to the Agricultural College Magazine have been made by graduates of the Department. Amongst graduates I may mention the names of Messrs. Mahajan, Kottur, Gadgil and Mutkekar as showing an intelligent interest in their work, and amongst non-graduates Mr. Umar Shah, Superintendent of Mirpurkhás Farm, and Mr. Itgi, Overseer, Gadag Farm.

Amongst the older members of the Department who are mostly L.Ags., besides Messrs. B. M. Desai and Gul Mahomad and Ráo Sáheb Kulkarni, I desire to mention the names of Messrs. Gulabbhai, Shewade, and Gokhale, Superintendents of Surat, Dhárwár and College Farms, and of Messrs. Tagare and Kogekar amongst district officers.

Interesting papers were written by the more experienced officers of the Department for the Conference held in September which were appreciated by such an excellent judge of their value, as Mr. G. Gammie, Imperial Cotton Specialist.

Arrangements have been made to supply subordinate officers of the Department with copies of the bulletins of the International Institute of Agriculture, Rome, and with other publications. It is hoped that this and other measures to stimulate and encourage subordinate officers to display real interest and enthusiasm in their work will be effective.

CHAPTER II.

Agricultural Education.

8. The hostel at the College was not ready for occupation till after the close of the year, and even then not the whole of it was available. The drainage system was not begun and it has been very difficult to secure proper sanitation. It is encouraging to note that the number of first year students entered at the close of the year is 43 as compared with 38 in 1912, and that the total number of students is 110 as compared with 104. The success of the Agricultural College in this Presidency appears to be assured, and the wisdom of introducing the degree of Bachelor of Agriculture cannot be doubted. It is possible that the syllabus is too extensive and that some modifications are necessary,—perhaps in the direction of making some of the present subjects for examination optional; but the connection of the College with the University of Bombay has, in my opinion, raised the status of the institution and the standard of teaching.

The following sums have been spent on the construction and maintenance of the College since 1905:—

	1905-06.	1906-07.	1907-08	1908-09.	1909-10.	1910-11.	1911-12.	1912-13.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Construction	72,897	91,178	1,30,751	1,44,969	1,19,974	1,14,92[illegible]	59,266	99,621
Maintenance including Staff	...	...	23,036	53,609	84,278	87,588	95,774	88,093

It is evident from these figures that Government have endowed the College in no niggardly spirit, and it is satisfactory that the initiative taken by Govern-

ment in the matter has been appreciated in this Presidency, as is evidenced by the growing popularity of the institution.

The College is not devoted merely to teaching, but serves as a centre for activity in connection with agricultural improvement and the dissemination of agricultural information. The library, which has received liberal grants, now contains nearly 6,000 volumes, and is consulted by gentlemen from all parts of the Presidency as well as by College students. A catalogue is in course of preparation, which will be of great service to officers of the Department and others.

9. The results of the University Agricultural Examinations are not satisfactory compared with those of last year.

The percentage of passes for each year is as follows :—

	Percentage of passes.	
	1911-12.	1912-13.
First Examination in Agriculture	70·9	54·8
Second do. do.	88·8	82·6
Bachelor of Agriculture Examination	81·5	73·3

Reasons for the marked decline in the percentage of passes have not been given by the Principal, but the failures in the first examination are ascribed chiefly to failure in mathematics and practical agriculture which were the causes last year, or in chemistry. Mathematics is not a very important subject for agricultural students, but the other two subjects are essential. In future reports it is desirable that a fuller explanation of failures should be given, because a decline in the percentage of passes may be due to a raising of the standard of examination as much as to deficiencies in the ability or training of the students.

This year's calendar gives an account of the number of B.Ags., since 1909 and the occupations in life which they have taken up. It shows that they have no difficulty in finding careers, and this year out of seventeen graduates four have returned to their own lands or have engaged in industries dependent on agriculture. Some difficulty has been experienced in obtaining graduates for posts in the Department, and several estate owners cannot find graduates willing to accept excellent appointments offered. There appears to be a fear amongst graduates that they will not receive good treatment from private employers: it is hoped that this lack of enterprise will disappear.

The Department would prefer to obtain men who have had some experience in the management of private estates, and there appears to be no foundation for the dread of private employment which exists.

10. The Agricultural School was not removed from Poona to Loni again, because the buildings were not completed, and the same cause prevented the opening of the new school at Devi Hosur in Dhárwár District. The delay in the construction of buildings, except in Sind where most of them are constructed departmentally, is one of the chief reasons for slow progress in the development of the Department in certain branches. It is a question for consideration whether a special Engineer, with a knowledge of the construction of buildings suited to the requirements of the Department, should not be engaged. The buildings constructed on many of the farms in the Presidency are often far too elaborate and defective in practical details, and are in marked contrast to the cheap and thoroughly suitable constructions built by Mr. Henderson in Sind.

The number of Bráhmin boys in the school is large, namely, 26 out of 43, and though it is satisfactory that the Bráhmin community should be willing to

send their boys to a school where so much manual labour in the field is exacted, I should like to see a much larger proportion of the sons of village patels, for whose benefit the school was primarily intended. It is hoped that Revenue Officers will do their utmost to induce patels to send their sons to the school.

I have received two offers of land for an agricultural school in the Panch Maháls District, and one of them will be selected for the approval of Government in the course of a few days. Land was offered in Kaira District, but it was not suitable. Mr. V. K. Pisal, Patel of Jambul, táluka Kalyán, has offered 175 acres of land for the establishment and endowment of a similar school to benefit the farmers of his own and surrounding villages, and offers of scholarships have been made to me for the school by three gentlemen. Proposals for the establishment of the school will be submitted shortly. At Alibág Sardár P. K. Biwalkar is building a Vernacular Agricultural School and is training at his own expense a graduate who will become Head Master in November next.

There can be no doubt that these schools are demanded eagerly by the more enlightened amongst the agricultural community, who desire to give their children a more complete education than that obtained in rural primary schools and one which will fit them to carry on their fathers' calling. I consider that the question of supplementing the teaching of the three R's, which is given in rural schools, with an organised system of instruction suited to agricultural conditions, is one of the most important problems which this Department, in consultation with the Educational Department, has to solve. In other countries greater success has attended a system of peripatetic instruction than farm schools, but it must be recognised that the requirements of different localities vary enormously.

In Sind the vernacular agricultural school was opened at Mirpurkhás, in order to provide training in agriculture to zemindárs' and cultivators' sons. The course lasts for 12 months, with two sessions. There are eight boys, with accommodation for 10, but a large number of applications for admission next year have been received. The buildings were constructed departmentally and cost only Rs. 3,500. The lessons have been prepared by the Head Master, a graduate, under Mr. Henderson's guidance and are eminently practical and suited to Sind conditions. The success of the school has been due to Mr. Henderson's personal attention, and it reflects the greatest credit on him.

11. The classes for the instruction of cultivators in special subjects on certain farms, have not attracted quite the class of men we desired, but 15 men attended the class at Mánjri for instruction in the cultivation of sugarcane and the preparation of raw sugar, 11 men that for dairying at the Kirkee Dairy, and a small number attended the classes in special subjects, given by Mr. Patwardhan at the Ganeshkhind Botanical Garden. I paid a visit to the classes held at Mánjri and the Dairy, and found that all took an interest in the work, but many were students or sent by Native States and few with any direct interest in land were present.

12. Some material for the establishment of a workshop and training school for cultivators and others desiring to obtain a knowledge of how to manage oil-engines and pumps was purchased before the close of the year. The workshop is to be situated beside the tanks constructed for experiments in water lifts, and it will serve the purpose of conducting comparative experiments with different kinds of pumps, of training drivers and cultivators owning power plants and of giving instruction once a week to the senior students at the College.

The workshop should be of great benefit to agriculturists and should go far to remove the chief obstacle to the introduction of power plants in the Presidency. Ignorance of the elementary details of the management and construction of oil engines and pumps causes stoppages which could be prevented or remedied easily, and these lead to constant trouble and consequent expense in remote villages.

CHAPTER III.

Research and Experiment.

13. The officers of the Department are occupied mostly with teaching or district work, and research has to be subordinated to these duties. However, the Principal and Professors of the College have been able to carry out some research work of their own and to direct enquiries conducted by officers subordinate to them.

The Agricultural Chemist and his staff, in addition to routine analysis and answering enquiries from the public, have been able to throw some light on the adulteration of vegetable oils with mineral oil which appears to have become serious and on the suitability of the cake of certain oil-seeds as food for cattle or as manure. They have continued researches on the "ráb" system of rice cultivation, on the occurrence of salt in black soil and on the milk supply of cities.

The Economic Botanist and his staff have continued research work on fruit, such as mangoes, grapes, pomegranates, citrus varieties, etc., and on fungoid diseases of fruit trees, sugarcane, potatoes, betel-vines and on such staple crops as jowár, bájri and rála. The time of the Economic Botanist and many of his assistants has been devoted largely to studies in the morphology and histology of fruit trees, the betel-vine and plants of minor economic importance. The classification of rices of the Presidency has been continued on systematic lines. Selected wild grasses have been sown to get seed and specially to observe the behaviour of the plants during the hot weather. The constitution of fodder brought into Poona as head-loads was analysed botanically, and the more common species fed to cattle separately, with a view to ascertain the liking or aversion shown by them.

Except for researches on the fungoid diseases of some staple crops, the staff of the Economic Botanist has not been able to do any work of direct economic importance on the staple crops of the Presidency. In my opinion it is essential that a Botanist with a thorough and up-to-date knowledge of plant breeding on Mendelian lines, should be appointed to undertake systematic improvements in the staple crops of the Presidency, with a view to improve their yield and resistance to disease. Such a Botanist should be able to devote his whole time to research. It is impossible to expect anyone whose primary duty is to pay personal attention to the teaching and training of students, to undertake such a task.

It is hoped that the request of the Government of Bombay for such a man will be complied with without delay.

14. Experiments have been continued at the Agricultural Stations on the same lines as in previous years. A summary of the most important experiments was given in last year's report, and full details are recorded in the reports of experimental stations.

It will suffice if a few points of interest, which have come to notice during the year under report are mentioned.

At Jalgaon a farm of 200 acres has been acquired for a seed farm to serve as a centre for the distribution of a pure variety of roseum cotton which has been selected from the half dozen types that constitute the mixture grown at present in Khándesh. This variety called N. R. Roseum has been found to be much superior in yield and ginning percentage to other types. It also matures earlier, which is very important in Khándesh where the season is short, and in years in which the late rains are deficient its superiority in yield is especially marked. The bolls open well and uniformly, which also is very important now that the cost of picking has increased and it is desirable to shorten the time and trouble expended on picking. Thirteen registered growers have been selected from the best cultivators all over Khándesh. They have been supplied with seed grown on Dhulia Farm sufficient to sow 352 acres, and the Department

has the option of purchasing back all the seed produced at the same rate as the seed was supplied. Special clauses have been inserted in the agreement as to purifying the crop and supervising the ginning.

A beginning has thus been made in laying the foundations of an organised effort to improve the cotton of Khándesh on a large scale.

Altogether 172 tons of improved hybrid cotton seed were distributed in British and Baroda villages near Surat, and nearly 11,000 acres were sown. The estimated outturn of the crop was 5,605 bales, but this was exceeded owing to the favourable conditions at the close of the season.

A special staff was engaged to assist the permanent officers of the Department in distributing seed, and in supervising sowings and cultivation and the despatch of the cotton to the four depôts established by the Bombay Cotton Syndicate. The Syndicate agreed to pay 5 per cent. above the market rates as last year, but terminated their agreement when purchases of something over 3,000 bales had been effected. Disputes as to the proper market rates became acute in April and were the cause of the termination of the operations. In June the Syndicate began to make complaints as to the quality of the cotton, but as the spinning tests are almost identical with those reported for Hybrid 1018 P/G on page 26 of the annual report for 1909-10 and this is the cotton which has been approved for good spinning test and ginning qualities combined, it would not appear that any deterioration has taken place. Moreover the average blow room loss, which is a most important factor in the value of cotton to the mills, is reported to be about 7½, a figure representative of a quality of cotton intermediate between Navsári and Superfine Surats. The blow room loss of Fine Broach Cotton is on the average 9 to 10 per cent.

In spite of the dissatisfaction caused amongst the cultivators by the termination of buying by the Syndicate before the end of the season, enough seed to sow about 7,900 acres have been distributed for sowing this year. Arrangements for supervising the sowing and cultivation and for certifying the origin of the produce are being continued, and it is believed that these measures will be sufficient to secure to the cultivators a good price from local merchants, who appear to be eager to secure the cotton.

The distribution of imported Navsári seed round Dhárwár has continued, and at the annual auction 595 nagas of 1,344 lbs. each were sold at prices ranging from Rs. 200 to Rs. 161 as compared with Rs. 138 for Kumpta. In 1912, 443 nagas were sold at prices ranging from Rs. 203 to Rs. 170 as compared with Rs. 120 for Kumpta. It is to be regretted that some cultivators attempted on the last day to introduce into the auction over 30 nagas of Broach cotton intentionally mixed with Kumpta. The mixture was detected and the cotton rejected. Such practices are not only dishonest but foolish, and may do immense harm to the best interests of the cultivator. "Honesty is the best policy" is a motto which every farmer must learn and appreciate, as it is essential to his prosperity all the world over.

There was a large demand for Cambodia cotton near Gadag, owing to its success in a bad season last year. Unfortunately some cultivators were foolish enough to buy at high rates seed from local dealers which was mixed with nearly 50 per cent. of Dhárwár-American. Moreover the season was an unusual one and even more unfavourable to Cambodia than to Dhárwár-American. However 493 nagas were sold at the auction at prices ranging from Rs. 200 to Rs. 161 as compared with Rs. 140 for Dhárwár-American. Praise is due to the enlightened attitude of the Kurtkoti Agricultural Association, which purified the fields sown in the village and obtained a rate Rs. 15 higher than that obtained for the special grade and Rs. 20 above that obtained for first grade Cambodia. This is not the only instance where an enlightened policy has obtained for a village a high reputation, which is a commercial asset of value in farming. Cambodia cotton from other than departmental seed was rigidly excluded from the auction.

I visited Dhárwár and Gadag farms with Mr. Gammie, Imperial Cotton Specialist, and Mr. Gilbert, and the results of the experiments carried out for

several years on these farms were reviewed. It has been decided in consequence, to confine the Dhárwár farm to experiments in Broach and Kumpta coftons and the Gadag farm to Cambodia and American cottons, though trials of other cottons are to be carried out on a small scale.

Also it was decided to start a new line of work at Gadag for the improvement of Dhárwár-American Cotton, which is composed of two distinct varieties. The seed of these varieties have been separated, and tests of the yield of each are to be conducted to see whether the deterioration of yield and quality is not due largely to the mixture. The two varieties are Upland Georgian and New Orleans, which have survived from those introduced about 1889.

Cambodia cotton in North Gujarát did well this season, confirming the results of previous trials. A crop which was sown in May with irrigation gave an outturn of 1,592 lbs. of seed cotton per acre, and the quality was reported to be good. The cotton has attracted the attention of cultivators, and 20,000 lbs. of seed were applied for; but 2,000 lbs. only were distributed as it was considered desirable to test Cambodia against Lalio further, before distribution is undertaken on a large scale. Experiments carried on at the College Farm now tend to show that Roseum Cutchica may be the best variety of cotton for general introduction in the Deccan. On the better types of black soil of the Deccan where rainfall is good, Broach cottons show promise as a dry crop, if well cultivated.

Mr. G. D. Mehta's experiments in methods of improving the quality of cotton seed which are described in Bulletin No. 53 of 1912, were tested on a field scale at the College Farm. The results indicate that considerable improvement in the germination, vigour of growth, and consequently in the outturn, ginning percentage and quality of the cotton, is possible. Mr. Schutte is getting the apparatus required made cheaply, and it is hoped that it will be introduced shortly on all the cotton farms of the Department.

In Sind the 40 tons of "Triumph" variety of American cotton, which arrived too late last year, have been distributed. Reports received up-to-date from the inspecting staff show that a bumper crop is anticipated on the Jamrao Canal, but a poor crop in Upper Sind, where the supply of water in the early part of the season was deficient and the unusual rains encouraged weeds. The Syndicate formed in Bombay for the purchase of the cotton have erected gins at Mirpurkhás and Shikárpur, and the cotton has commenced to come into Mirpurkhás already.

Reports received from the Imperial Institute as to the "Triumph" variety grown on our farms last year are favourable, and tend to show that no deterioration is taking place.

15. The results of experiments for many years on the cultivation of sugarcane and the manufacture of raw sugar were mentioned in last year's report. Mr. Knight summed up the results in a paper presented to the Conference held in September and a bulletin and leaflets on the subject are to be issued shortly. The results are definite and it is hoped that all of them will be appreciated by cultivators. Apparatus for work on the selection of canes and to investigate further the ratio of glucose to sacrose in the juice has been ordered. Recent experiments have tended to prove that the quality of raw sugar depends little on the kind of manure applied to the crop, but rather on the stage of ripeness at which the canes are cut for crushing and the methods employed in manfacturing it.

16. It is difficult to give a general account of the results of experiments on cereals. Much useful work has been done on them and the information is to be found in the reports appended. The results are local in character and not of widespread importance.

Australian wheat has been found to be most resistant to rust on Mánjri farm owing to its maturing rapidly. Upper Sind jowáris have been proved to be superior to those found in Lower Sind and to those imported from the Presidency. The latter are too late in maturing, an objection which is fatal in so many cases in India to the introduction of superior varieties.

Experiments in transplanting fewer seedlings of rice and in reducing the area of the seed bed in consequence, tend to show that the practice which yields the best results is to sow about one-third the usual quantity of seed in the seed bed so as to raise strong seedlings and to transplant them in bunches of four instead of 16. The saving in seed valued at Rs. 1-8 per acre would be enormous, if the practice were introduced with uniform success. The practice now advocated in Madras of transplanting single seedlings does not give good results in the Konkan. The Japanese method of selecting paddy seed by immersing it in a solution of one lb. of salt to two lbs. of water and skimming off the light seed which floats gave an increased outturn of 136 lbs. of paddy per acre. The light seed can be used for eating and the method deserves further extensive trial by cultivators, as no loss could result. The heavier seed to be used for sowing must be dried in the shade after immersion.

Selection of cereals has been continued; but in order to effect marked improvements, especially in the breeding of varieties of wheat more or less immune to rust which causes enormous loss, a botanist whose whole time can be devoted to working out these problems is required.

17. The growth and utilisation of fodder is an important problem in this Presidency, and except in Gujarát its importance is little understood by agriculturists. To induce cultivators to grow any crop which is merely a food for cattle and does not bring in a cash return, is very difficult. To this short-sighted policy, the low outturn of crops in many parts of the Presidency can be attributed. Bullocks which have been kept in a state of semi-starvation for three or four months in the year, are given expensive rations when the ploughing season commences, but this does not repair the damage to their constitutions which has taken place. The complaint of the indifferent cultivator is that his bullocks cannot draw such implements as could eradicate the weeds which smother his crop. The argument against improved methods moves in a vicious circle, but the root evil is the absence of a proper supply of fodder throughout the year. It is only in Gujarát and certain parts of the Southern Marátha Country, where the fine bullocks must be fed to live, that the cultivator keeps a stack of hay or karbi sufficient to provide his animals with ample fodder.

The work of the Department on fodder has been carried on simultaneously on different lines.

The results of experiments carried on for some years on storage of fodder were given in last year's report. These experiments have been continued. It has been discovered that the Department of Military Dairy Farms possesses a plant which can shred and bale karbi efficiently, and proposals for setting up such a plant have been submitted to the last Conference of Commissioners of Divisions. The whole question of the storage of fodder has been dealt with in the report submitted to them.

Secondly, the Department has tried to discover new sources of fodder. Important experiments have been carried out in the feeding of prickly-pear to cattle. The experiments were started in consequence of the appearance of a letter of Mr. A. Norton, an American Missionary of Dhond, in the Bombay Guardian in August 1912. Mr. Norton's work was studied on the spot and a systematic experiment was started in January 1913 at the Civil Dairy, Kirkee. Six bullocks were purchased from the famine-stricken cattle of Ahmednagar. A full description of the process of feeding the pear and the results have been given in a paper presented to the Conference by Mr. E. W. Horn, Manager of the Civil Dairy. This is to be published as a bulletin. It has been proved conclusively that prickly-pear, if fed with 6 per cent. cotton seed, is a valuable emergency fodder in famine times. The spines can be burnt off by kerosine blow lamps and the pear prepared at a cost of Rs. 1-4-0 per 1,000 lbs. in a day of 10 hours. If a cultivator purchased an "Effective" lamp at a cost of Rs. 22, he could feed a pair of bullocks with pear and cotton seed at a cost of Re. 0-4-9 per day without allowance for wages. The pear was used for dairy stock at Mánjri when fodder was dear and effected a considerable saving.

Mr. P. J. Mead, Collector of Ahmednagar, informs me that the demonstrations of the use of pear carried out by the Department at the cattle camps were very successful and have convinced the leading cultivators.

The cotton tracts of the Presidency, especially Khándesh, suffer from lack of fodder. Cultivators often sell their cattle at the end of each season and purchase new ones because of scarcity of fodder. In the cotton tracts of America cotton seed hulls are used extensively as fodder. Experiments with the feeding of cotton seed hulls were carried out at the request of the Indian Cotton Oil Co., Ltd., of Navsári both on milch cattle and working bullocks. The experiments tend to show that the hulls are equal in value as a fodder to ordinary karbi. If the feeding of hulls and cotton seed cake could be substituted for the wasteful practice of feeding cotton seed whole, immense benefit to the cotton tracts of the Presidency would result.

The value of berseem or Egyptian clover as a fodder crop was demonstrated to cultivators in Sind owing to the scarcity of fodder, and it was in great demand. Few zemindárs, however, on the Jamrao will take up its cultivation regularly, because it does not give a direct return in cash. The crop did very well at Dohad Farm after rice.

At Nadiád Sundia jowári and lucerne proved to be the most useful fodder crops to grow, when the season has turned out to be a bad one.

Wal and the half-dried stalks of groundnut appear to be useful fodders, which can be obtained under very varied conditions of soil and rainfall.

18. Considerable progress has been made at the Tegur Grass Farm. It has been proved that large areas can be cleared of stones and jungle at small expense by selling the scrub growth to charcoal makers. The mower can then cut 800 to 900 lbs. of grass at a cost of one rupee as compared with 400 to 500 lbs. per rupee in the case of cutting by hand. The mower cuts 5,000 lbs. a day or the produce of four acres, and owing to the time and labour saved, grass can be cut when it is nutritious and not fibrous.

The grass is being stored in stacks, and in pit and masonry silos so that we may find out the best method of preserving it.

There appears to be a great future for silage, and silos, both pit and masonry, have been made on many farms.

19. Tillage with iron ploughs and improved implements has continued to receive attention. A second Bajac plough was purchased and demonstrated at Surat, and a great demand for it arose immediately. There is much land which is going out of cultivation in Olpád Táluka owing to the growth of weeds, which can be got rid of only by ploughing about 15 inches deep. The new plough is a two-gang one.

In Dhárwár District the Bajac plough continued to work for 121 days out of a possible 152. It has been found more satisfactory and economical to carry out ploughing with a complete staff of men and bullocks at Rs. 35 per acre. Without allowing for capital outlay and depreciation of the plough itself, a profit of Rs. 390 was made during the season. A field ploughed last year was rented for Rs. 460 as against Rs. 320 before it was ploughed. The amount of takávi taken to cover the cost of ploughing was Rs. 800: after deducting interest at Rs. 6-4-0 per cent. on the takávi, the net profit to the owner amounted to Rs. 90.

There has been no difficulty in obtaining land for ploughing by the steam plough which has arrived at Ránebennur. The land is in large blocks so that little time will be wasted in moving. The ploughing is to begin on 1st November, and there appears to be every prospect of success.

20. The effects of good tillage carried out for four or five years were very apparent on the College Farm this year, where the remarkable absence of weeds and the splendid jowári crops have attracted much attention. On deep black cotton soil which is clean of weeds, it is doubtful whether deep ploughing with iron ploughs more than once in three or four years is profitable, except where sugarcane or garden crops are grown.

In Sind the success of the Egyptian plough, which costs only Rs. 5 and can be made and repaired in any village, has been remarkable. Four hundred of these ploughs were distributed through the Department during the year. Three private firms have taken up the manufacture of these ploughs and their sale direct or through the Department. The total number of ploughs sold in Sind during the year was nearly one thousand.

21. A leaflet has been issued giving information as to the implements which the Department can recommend. The list includes iron ploughs, levellers, chaff cutters, water-lifts, Olpád or Norag threshers, etc. Much work has and is being done on the improvement of indigenous implements. Preliminary inquiries go to show that the indigenous plough is capable of much improvement. Professor Knight has improved the bullock yoke enormously and iron mhots and accessories for them are becoming popular. In a few years private enterprise in the manufacture and sale of indigenous implements is likely to extend rapidly.

22. Complaints have arisen in Sátára District that crops, such as jowári and chillies, following foreign groundnuts mature badly. Enquiries have been made into the complaints and a plot has been rented to investigate the causes, but the evidence collected at present points to an excess of nitrogen over mineral plant foods. In seasons of deficient late rains, such as have occurred in recent years, such a condition of the soil is especially injurious. The crops have been noticed to make a rapid growth of foliage and to fail to give a proper yield of grain at harvest.

CHAPTER IV.

Shows and Demonstrations, Aid to the Public, Agricultural Associations and General Progress.

23. During the year under report 30 shows and demonstrations were held, which is a large increase over the number held last year.

Large and important shows were held at Sukkur and Mirpurkhás in Sind and at Pen and Sirsi in the Konkan. Shows on a smaller scale which were interesting and well attended took place at Kelva-Máhim, Broach, Dápoli and other places.

Many useful demonstrations were given to cultivators on farms or in connection with local fairs. Those at Mánjri and Surat Farms were much appreciated: the cane crushing mills and methods of preparing gul at the former and the new Bajac plough and lantern slides at the latter attracted much attention. Shows are started generally on the initiative of agricultural associations which collect money by subscriptions and obtain small contributions from the Local Boards and Municipalities. The Department gives a contribution and sends and arranges exhibits and demonstrations of implements. The Divisional Inspector of Agriculture helps to arrange the programme and details of management, and officers of the Agricultural, Veterinary and Co-operative branches of the Department give lectures in the Vernacular. Collectors and other district officers give valuable help and support, and the shows are much appreciated by cultivators not only for the excitement which the event causes in the somewhat dull monotony of rural existence, but for the new ideas which they are able to pick up from the lectures and demonstrations and the descriptions of trials of new methods made by some of their brethren. Extra work is thrown upon officers of the Department and their time is taken up, but the occasions serve to bring them into close touch with many cultivators whom they might never see and to advertise the work of the Department. The prizes presented arouse a spirit of emulation amongst the cultivators and certificates and medals are valued highly.

Demonstrations are on a smaller scale and few lectures are given, but more time and attention is bestowed on showing the working of implements or furnaces for boiling sugarcane juice. Many of these demonstrations have led to the adoption of iron ploughs, iron mhots, Poona or multiple furnaces, etc.,

on a considerable scale. It is hoped that the demonstrations of the preparation of prickly-pear in Ahmednagar District have had a permanent effect, and it is certain that the demonstration of spraying of grape vines to prevent mildew round Násik has led to the adoption of the practice.

24. The district staff under the Divisional Inspectors of Agriculture have done much valuable work this year in giving aid to the public.

Immense quantities of seed have been distributed of different varieties of cotton, groundnut, potatoes, etc., from different farms and depôts. A keen demand for selected seed has arisen in many districts and it appears likely that in the course of a few years a reliable private firm could establish a good business in the sale of seed. Messrs. Ralli Brothers have set an excellent example in Sind, by specially ginning Bhit-Shah cotton and distributing the seed. It is a pity that other merchants and ginners have not a better eye to their best interests, which are wrapped up in the improvement of neighbouring crops.

Several European and some Indian firms stock ploughs and other implements on some of our farms, which are sold for cash to cultivators by the farm staff. Spare parts are stocked and supplied on the V. P. P. system, and this has removed one of the chief obstacles to their introduction.

Our district staff tour throughout the district and demonstrate the use and care of iron implements or the method of steeping cereals in copper sulphate solution to prevent smut and give advice to cultivators who require it.

25. The Economic Botanist and his staff have visited gardens affected with disease, and have demonstrated methods of combating them, or have given advice as to pruning and grafting. Nearly 50,000 plants have been distributed and numerous enquiries from correspondents have been answered.

The Agricultural Chemist received 526 samples for analysis from the public and has kept in close touch with the oil-pressing industry.

Numerous enquiries are addressed to me which are answered, if possible, immediately, or are referred to other officers for disposal. The work of the Department appears to have become widely known in the Presidency and other parts of India.

26. The arrangement with the Bombay Cotton Syndicates near Surat and in Sind and the auctions of Broach and Cambodia cottons near Dhárwár have been mentioned already. An effort has been made during the year to utilise Agricultural Associations and Co-operative Societies to aid in the collection and distribution of seed and implements. The Dhárwár Co-operative Seed Society registered about 100 members during the year and distributed cotton seed. A similar Society has been started in Gadag. The Dhárwár Agricultural Association has helped in the collection of pure seed, and the work of the Kurtkoti Association has been mentioned already.

The Mutha Valley Co-operative Manure Society purchased a large quantity of oil cake and fish manure. I started with the help of Mr. V. H. Gonehalli, a Manure Society at Kelva-Máhim, which has been very successful owing to the able management of Ráo Bahádur Appaji Ganesh Dandekar.

Officers of the Department have been brought into closer touch with Co-operation and Agricultural Associations.

Mr. V. H. Gonehalli and Ráo Sáheb Kulkarni have done specially good work in this respect.

27. Agricultural Associations have done good work in organising shows and demonstrations. Many members, in response to a circular addressed to associations, have carried out demonstrations on their own lands and some associations have managed plots with the help of the Department. These have not always been a success, but continuous good tillage is necessary for a few years before the effect becomes apparent. It is proposed to systematise the work of associations by providing for regular meetings and the attendance of district officers of the Department at them, and the preparation of programmes of

work and a budget. Those associations which remain moribund will cease to be recognised.

The Deccan Agricultural Association has continued to publish the "Shetki and Shetkari", which is edited at the Agricultural College and has a monthly circulation of over 4,100 copies. The similar magazine in Kánarese published under the auspices of the Dhárwár Agricultural Association, but edited by Ráo Sáheb Kulkarni, has been successful. Numerous enquiries from cultivators received by the editors show that the magazines are appreciated, and they serve as a useful means of disseminating information as to improved methods.

The Broach Agricultural Association also has done useful work in issuing pamphlets in Gujaráti.

28. The following new Agricultural Associations came into existence during the year :—

(1) Krishi Karma Sangh, Honsnur in Bijápur District.
(2) Agricultural Association, táluka Máhim, district Thána.
(3) Prántij Táluka Agricultural Association in Ahmedabad District.
(4) Chándur Agricultural Association in Belgaum District.
(5) Kurutkoti Agricultural Association in Dhárwár District.

These bring the total number of associations up to 50.

29. In closing this chapter I will refer to the Agricultural Conference held at Poona from 15th to 17th September 1913. Though it took place after the close of the year under report, it was the culmination of the work of the Department during the last four years, and I shall not have another opportunity of referring to it in an annual report.

The organisation of the Conference was on new lines. Non-official gentlemen were kind enough to serve on the Managing Committee; a number of interesting papers were printed and distributed before the Conference, and sub-committees considered and reported on some of these. About 350 persons attended the Conference which was opened by His Excellency the Governor on 15th September. The demonstrations given on the College Farm, at the Ganeshkhind Botanical Gardens and Mánjri Farm, were witnessed by a large number of visitors who appeared to follow them with much interest.

The Conference gave much extra work to many officers of the Department, who wrote papers for it or organised demonstrations. I desire to record my appreciation of the assistance afforded by all the officers who wrote papers and organised the demonstrations. The latter work devolved chiefly on the College staff and was carried out with great efficiency; but the heaviest part of it fell on Professor Knight whose arrangements were admirable. Professor Knight was assisted ably by Mr. E. W. Horn and Messrs. V. G. Gokhale and G. R. Mahajan. I must express my thanks to my Personal Assistant, Mr. K. H. Gokhle for the valuable assistance which he gave me in organising the Conference.

CHAPTER V.

Agricultural Engineering.

30. Considerable progress has been made in this branch of the Department during the year in spite of changes in the personnel. Mr. Schutte's report shows that the number of enquiries as to pumping plants is increasing. Mr. Musto before leaving the Department wrote a useful leaflet for the guidance of those who contemplate the erection of plants and thus placed the work on a business-like footing.

There are eight plants owned by the Department which are in charge of the Agricultural Engineer. Three plants were completed for private owners and three were under construction. The Agricultural Engineer has had on hand the erection of six more plants for Government, including that of a workshop, with oil engines and pumps in connection with the experimental

tanks at the College. The completion of this workshop and training school will enable this branch of the Department to make much more rapid progress, as the absence of trained men to supply the Department and cultivators has been the greatest obstacle to progress. Cultivators will be trained in the use of plants for a nominal fee.

The office of the Agricultural Engineer has been removed to the College where there was ample room for it, and his establishment has been revised and made permanent. Mr. Paranjpe, who was senior Mechanical Superintendent, has been appointed as Assistant to Mr. Schutte, with a view to his qualifying as an Agricultural Engineer in another province.

31. The boring work in Gujarát was transferred during the course of the year from Mr. Main to the Agricultural Engineer. A special staff has been engaged by the District Local Board, Kaira, and the work which was carried on there for several years by the Department has been handed over entirely to it. The work of boring is carried on by advances from my personal ledger account and new rules have been framed on commercial lines.

Mr. Musto after leaving the Department invented a new type of boring machine which can be worked by hand labour or a bullock gear. The machine has proved a great success and is effective in soil or the hardest rock. The Department has made thorough trials of the machine and we wish to replace our present sets with Mr. Musto's patent machines, as soon as funds permit. The invention has stimulated demands for boring in the Deccan and the Southern Marátha Country. Temporary arrangements will be made to satisfy the demand as far as possible.

I anticipate a great extension of wells for irrigation owing to the invention.

CHAPTER VI.

Publications.

32. The following publications have been issued since those mentioned in the last year's report:—

Bulletins.

(1) Bulletin No. 54 of 1912.—"A note on Steam Ploughing".

(2) Bulletin No. 55 of 1913.—"An examination of the Seed Supply of the Poona District".

Leaflets.

(1) Leaflet No. 8 of 1912.—"Pumping and other Machinery".

(2) Leaflet No. 9 of 1912.—"The Treatment of the roots of fruit trees".

(3) Leaflet No. 10 of 1912.—"Green Manuring with Sann Hemp for dry crops in Gujarát".

(4) Leaflet No. 1 of 1913.—"Green fly or Aphis on Plants".

(5) Leaflet No. 2 of 1913.—"List of Implements recommended by the Department".

(6) Leaflet No. 3 of 1913.—"Sugarcane".

(7) Leaflet No. 4 of 1913.—"Farm Manure".

(8) Leaflet No. 5 of 1913.—"The preparation of land for irrigation in the Gokák Canal area".

(9) Leaflet No. 6 of 1913.—"Methods of field irrigation".

A list of the publications of the Department has been prepared, showing the vernaculars into which they have been translated.

33. My thanks are due to the Press and especially to the "Times of India" for the liberal way in which the activities of the Department have been reported.

CHAPTER VII.

MISCELLANEOUS.

34. In conclusion, I wish to express my appreciation of the way in which officers of the Department have satisfied the increased demand on their activities, caused by the spread of public interest in the work of the Department.

I have the honour to be,
Sir,
Your most obedient servant,
W. W. SMART,
Acting Director of Agriculture.

APPENDIX A.

No. 1853 of 1913-14.

Poona Agricultural College,
Poona, July 29th, 1913.

From

HAROLD H. MANN, D.Sc.,
Principal, Poona Agricultural College;

To

THE DIRECTOR OF AGRICULTURE, BOMBAY,
Poona.

Sir,

I have the honour to submit herewith the Report of the Poona Agricultural College for the year ending June 30th, 1913.

COLLEGE BUILDINGS.

2. The year under report is the fifth since the establishment of the college as a separate institution. It has had the use of the whole of the new buildings during the year, with the exception of the hostel. This latter was expected and promised to be complete before June 1913, but has not been finished. It is now expected to be ready by September in the present year, but has already been partly occupied by students in its unfinished state.

UNIVERSITY AGRICULTURAL COURSE.

3. The University Agricultural Course to the teaching of which the main energy of the College is devoted, is now in full operation. It is on the whole satisfactory, but will need modification in detail.

SHORT COURSE.

4. The short course, started four years ago, as an addition to the College work, is intended for farmers' and landowners' sons. For this the sole qualifications are that the student should know English and have a fairly good general education. The training given is essentially a practical one, and is designed to give the men as good an acquaintance as possible with the best methods of agriculture applicable to our areas. There was at first some doubt as to whether there was a real demand for this course, but this is now entirely dissipated, and the number of the suitable students tends to increase. The actual number of students attending the course has been as follows:—

1909-10	4
1910-11	12
1911-12	13
1912-13	15
1913-14	15

COLLEGE STAFF.

5. The staff of the college has suffered no permanent losses during the year, but several of its members have been temporarily placed in more important positions elsewhere. Ráo Sáheb G. K. Kelkar, the very much valued Assistant Professor of Agriculture has been on leave since the end of November 1912, and is not likely to return for some time, as he has been recently appointed to act as Extra Deputy Director of Agriculture as a result of the absence of Mr. T. F. Main. His place has been taken at the college by Mr. G. K. Ranade, L.Ag.

Mr. H. M. Chibber, M.A., Assistant Professor of Botany, was appointed to act as Professor of Botany at the Gujarát College, Ahmedabad, from February 1913. His place has been taken very efficiently by Mr. G. B. Patwardhan, B.Sc.

I was on privilege leave from March 29th to May 30th, 1913, during which time Professor W. Burns acted for me in addition to his own duties.

The position of Assistant Professor of Chemistry which has never hitherto been held by anyone, was filled in June 1913 by the appointment of Mr. D. L. Sahasrabuddhe, B. Sc., L. Ag., who has been Lecturer in Chemistry since the establishment of the college. Mr. N. V. Kanitkar, B. Ag., takes his place as Lecturer in that subject.

Mr. D. D. Sanga, G. B. V. C., Lecturer in Veterinary Science, one of the oldest members of the college staff has been on leave almost all the year under report, but returned to duty on June 1st, 1913. His place has been taken by Mr. F. Gracias, G. B. V. C., and the latter's place was filled by Mr. B. B. Joshi, G. B. V. C., who was seconded from the Civil Veterinary Department for the purpose.

STUDENTS.

6. The number of students this year is slightly higher than in 1912. The actual figures for the past five years have been as follows :—

	1909.	1910.	1911.	1912.	July 1913.
First year students	38	36	38	38	43
Second year students	26	33	24	27	25
Third year students	39	27	28	22	26
Short course students	4	12	13	15	15
Special and post Graduate students ...	1	2	1	2	1
Total ...	108	110	104	104	110

The students during the last four years included in the above table have come from the following parts of India :—

	1910.	1911.	1912.	1913.
Bombay Presidency { Deccan	32	28	28	28
Bombay Presidency { Southern Marátha Country and Konkan	35	34	25	29
Bombay Presidency { Gujarát	18	23	25	27
Bombay Presidency { Sind	6	4	6	4
Eastern Bengal and Assam	8	2	...	...
Central Provinces	...	1	...	1
Bengal	2	1	...	...
Central India	...	...	3	3
Nizám's Dominions	4	2	2	5
South India and Ceylon	5	9	14	11
Burma	...	...	1	1
United Provinces	...	...	...	1

Arranged according to the castes or classes from which they come, the students stand as follows :—

	1909.	1910.	1911.	1912.	1913.
Bráhmins	68	64	54	45	45
Maráthas	4	5	8	4	5
Lingáyats	5	6	5	2	5
Pátidárs (Gujarát)	4	5	4	3	2
Mahomedans	7	7	4	10	10
Pársis	1	2	4	9	9
Eurasians	...	...	...	1	1
Others	19	21	25	30	33

7. These students may be divided into three classes :—

(*a*) By far the larger number are qualified to study for, and intend to take, the agricultural degree of the Bombay University. The qualification on which the Bombay University insists, namely, the Previous Examination or its equivalent, is insisted on in the case of practically all students from the Bombay Presidency itself, and no students can, of course, appear for the University Agricultural degree without it.

(*b*) The second class consists of a few students who are not admissible to the University Examination, but who are taking the regular course along with the first class

of students. These exceptions arose from the fact that it has been decided by Government to allow scholars to be received from Sind who have only passed the Matriculation Examination, provided that they were to receive the same course, and pass by the same standard as the University demands. Under this ruling, students have been received every year since 1908. At the same time some applications were received from other Governments in India and Ceylon to be allowed to send students and from private persons outside the Presidency for admission to the College, where the applicants were not fully qualified for the University course. Where there was evidence to show that such students could properly follow the course, a small number have been admitted, as follows :—

	Admitted in 1909.	Admitted in 1910.	Admitted in 1911.	Admitted in 1912.	Admitted in 1913.
Bengal	...	...	...	...	...
Eastern Bengal and Assam	2	...	...	...	...
Nizám's Dominions	...	...	...	...	...
Sind	1	1	1	2	1
Bombay Presidency and Native States (Subordinate)	...	2	3	...	...
Ceylon	...	2	...	5	...
Goa	...	...	1	...	...
United Provinces	...	...	...	...	1

(*c*) In the third place, we have the short course students already referred to. The places from which they come are as follows :—

Deccan	1
Southern Marátha Country	1
Gujarát	3
Nizám's Dominions	5
South India	
Central India	1
Bombay	3
Central Provinces	1

As has already been stated, all these are taking the course for the sole purpose of putting their training to advantage in actual farming.

8. In addition to these classes, we are being occasionally requested to undertake the training of men for special purposes. At present we are training a man specially for botanical work under the Department of Agriculture, Burma.

University and other Examinations.

9. At the University Agricultural Examinations held in 1913, the number of candidates shown in the following list were presented, with results, as indicated :—

	Sent up.	Passed.	Failed.	Percentage of passes.
First Examination in Agriculture	31	17	14	54·8
Second Examination in Agriculture	23	19	4	82·6
Bachelor of Agriculture Examination	19	14	5	73·6

The results are fairly satisfactory except in the first year's examination. The large percentage of failures in this year were chiefly due to failure in Mathematics or Chemistry or in practical agriculture.

A special College Examination of the students (referred to above) not entitled to take the University Examination, was held in February and March 1913 with the following results :—

	Presented.	Passed.	Failed.
First Examination in Agriculture	7	5	2
Second Examination in Agriculture	4	3	1
Final Examination for Diploma in Agriculture	4	3	1

SCHOLARSHIPS.

10. The number of scholarships offered by Government at this college is now fifteen per annum. Candidates must have passed the Previous Examination of the Bombay University or obtain the certificate from the Principal of an Arts College, which the Bombay University now accepts instead of that examination, and are selected by the Director of Agriculture in consultation with the Principal of the College. They are given by preference to the sons of cultivators and are awarded for the three years occupied by the course. The Director of Agriculture is empowered to extend the tenure of the scholarships to four years, and give a limited number to Matriculates, who afterwards will join this college, for study in an Arts College. During the last five years those students actually coming to this College have been awarded to candidates from the various districts as follows :—

	1909.	1910.	1911.	1912.	1913.
Deccan	...	2	5	6	2
Southern Marátha Country	3	3	3	2	8
Gujarát	2	3	6	...	2
Konkan	1	2	1	...	1

11. The students from Sind are on a different basis. They are appointed by the Commissioner in Sind, and are not required to have passed the Previous Examination in every case. We have now at the College, two such scholars from Sind in the first year, none in the second year, and one in the third year.

12. Other Governments and the public bodies have utilised the College for the training of scholars. The number so admitted since 1909 has been as follows :—

Date of entry.

	1909.	1910.	1911.	1912.	1913.
Government of Eastern Bengal and Assam .	2	...	...	...	...
Baroda Government	2	...	...	2	...
Sángli State	...	1	...	...	1
Jamkhindi State	...	...	...	1	1
Porbandar State	...	...	1	...	...
Kotah State	...	...	1	...	...
Vithalgadh State	...	...	1	...	...
Jamnagar State	...	...	1	...	...
Lingayat Education Fund	3	1	...	...	2
Ceylon Government	...	...	...	4	...
Bansda State	...	...	...	1	...
Rajpipla State	...	...	...	...	2
Junagadh State	...	...	...	...	1

13. During the year a new endowment has been made by a number of old students of the college and others in the form of an annual prize in memory of Mr. P. J. Bhatt, a distinguished graduate in Agriculture from this College, who died while pursuing his agricultural studies at Cambridge (England) in 1911. It is to be annually awarded to the student who stands highest in the University Examination for the Degree of Bachelor of Agriculture in agricultural chemistry. I have pleasure in recording my appreciation of the generosity of the donors of this prize.

Library.

14. The growth of the College library is very satisfactory. Six years ago it did not exist. On the separation from the College of Science being completed, a number of books (chiefly old and out of date) on Agriculture, Botany and Veterinary Science were handed over to us and formed a nucleus for the future. A special grant of Rs. 6,000 per annum was made in 1909 for library purposes, and was continued during the two following years. Since that time the annual grant has been Rs. 2,500. With the funds thus made available and a

number of presentations of books, the library has rapidly increased. The number of books in it at the end of the last five years has been as follows :—

1908-09	1,182
1909-10	2,780
1910-11	4,000
1911-12	5,040
1912-13	5,943

It is fairly consulted, not only by college students, but by gentlemen from all parts of the Presidency, and every effort is made to make it increasingly useful to the public.

College Quarters.

15. Considerable progress with regard to the building of college quarters has been made during the past year, but it is very disappointing that, in spite of repeated promises, they have not been made ready before the end of the year under report. The students have been permitted to occupy a portion of the unfinished buildings, but the condition of things is unsatisfactory, and the delay is very annoying. The Superintendent's quarters are completed, and we have now, in Mr. D. L. Sahasrabuddhe, B. Sc., L. Ag., Assistant Professor of Chemistry, an excellent resident superintendent. Practically, all the resident students amounting to ninety out of a total of one hundred and ten now live on the college property.

I cannot help referring to the great delay which has taken place in the completion of the sanitary scheme for the college buildings. The plans were drawn three years ago, but nothing has been yet done. Seeing that the whole arrangements at the bungalows, the farm, the student's quarter's and the college itself have been made with reference to this scheme,—in its absence the sanitary arrangements are very unsatisfactory.

Employment of Graduates.

16. The question of the employment of agricultural graduates has taken a new turn during the last year. A larger proportion of the students who have passed out this year than even before have gone to work on their own land. And a demand has arisen from many quarters for our men. The result has been that we have a greater call for men than we can supply. The demand has been, in fact, during the present year, greater than the supply. Private landowners, local bodies, agricultural associations and the like, have all applied for men during the past year,—and a number of them cannot be supplied. There remains, however, the somewhat disquieting feature that many of our graduates do not care to take employment under private owners,—but this will die down, I have no doubt, as time goes on.

Out of 17 graduates of the Agricultural College who have been employed in the past year, the direction of their activities is as follows :—

Employed on their own land or in connection with industries depending on Agriculture	4
Bombay Agricultural Department	5
Bombay Executive Government Service	2
Native State Service	1
Municipal and private bodies or other employers	3
Courts of Wards	1
Central Provinces Educational Service (Science and Nature Study)	1

Veterinary Dispensary.

17. The District Veterinary Dispensary at Bhamburda has been carried on as a College Dispensary during the year. During this time 282 in-patients and 564 out-patients were treated or a total of 846. Of these 327 were agricultural animals. The daily average attendance of in-patients was 12·8 and of out-patients 7·7. Out of 846 cases, 320 were treated free. Among contagious diseases there were eleven cases of rabies in dogs, and two bullocks were treated for hæmorrhagic septicæmia. Visits were occasionally paid by the Veterinary officers to the Civil Dairy, Kirkee, and the Agricultural College Farm. Villages within a radius of five miles were visited once a week by the Veterinary Officer to popularize the Hospital and treat cases. An outbreak of *Aptha Epizootica* occurred in the Pharsangi village and assistance was given in this case, and many visits were paid to the Sangam Wadi village to suppress an outbreak of *Hæmorrhagic Septicæmia*. Several post-mortem examinations on cattle, horses, fowls and dogs were held, that either died here or were brought for that purpose. The Superintendent, Civil Veterinary Department, Bombay, inspected the Dispensary on December 10th 1912, and the Deputy Superintendent, Civil Veterinary Department, Bombay, on September 16th 1912, and July 6th, 1913.

Other Matters.

18. During the year under report the college undertook the responsibility, for the third time, of giving the short three weeks' course in agriculture which all the junior members of the Indian and Provincial Civil Service have to take. It was attended by seven members during the present year, and the teaching was undertaken by Professors Knight, and Burns, and myself, while the Director of Agriculture also assisted.

19. The staff on the whole have worked well, and are doing a considerable amount of research, and also of demonstration work in addition to their own duties. I may repeat what I said last year that the College tends to become every year more and more of a centre for activity in connection with agricultural improvement and the dissemination of agricultural information. It has hence been visited by a constantly increasing number of landlords and other interested gentlemen on the one hand, and on the other by large crowds of cultivators. Every effort is made to stimulate this public interest, as it is felt that the permanent success of the institution must largely depend on the extent to which it can be maintained.

I have the honour to be,
Sir,
Your most obedient servant,
HAROLD H. MANN,
Principal.

APPENDIX B.

ACCOUNT OF THE VERNACULAR AGRICULTURAL SCHOOL, POONA, FOR 1912-13.

The Vernacular Agricultural School was established as an experiment, the object of which was to give a thoroughly practical agricultural training to boys who belonged to good substantial village families; and whose object in life was to cultivate and manage their own land. With this conception in view it was opened in Poona in June 1910, with a course of two years for boys by preference between the ages of 14 and 16 who had passed the fourth Maráthi Standard at least. It is placed under the control of the Principal of the Agricultural College, but is quite independent of the College, with an agricultural graduate as head master, though a part of the college farm is used at present for the practical training of the boys.

With a scheme of which these are the general outlines, the school has now been carried on for over three years. A year ago a survey was made of its work and an estimate of its probable success and practical utility. The additional year's experience has tended on the whole to justify the estimate then made.

The boys at present in the school number 43, derived from the various Maráthi-speaking districts as follows:—

	1st year.	2nd year.
Poona	5	5
Sátára	3	4
Sholápur	3	4
Ahmednagar	...	5
Násik	4	...
Khándesh	...	...
Ratnágiri	...	...
Thána	1	1
Belgaum	1	1
Kolhápur State	...	1
Sángli State	...	1
Janjira State	...	1
Sáwantwádi State	...	1
Other States	...	2

Arranged according to caste, the boys stand as follows:—

	1st year.	2nd year.
Maráthas	5	10
Bráhmins	11	15
Others	1	1

The head master has been, as in the previous year, Mr. K. M. Pawar, B.Ag., and he has put great enthusiasm and energy into the work. Such success as the school has attained is largely due to him. He has been assisted during the greater part of the year by Mr. R. Y. Hulkoti, B. Ag., who was placed at the school for training, with a view to becoming head master of the proposed Kanárese School at Devi Hosur in the Dhárwár District. He has taken to the work with enthusiasm also and promises to make a very successful head master there. He left on June 1st 1913 for his duties in Dhárwár.

The school has been supported by a number of local boards during the three years, and subsidies have been received as follows:—

	1910-11.	1911-12.	1912-13.
	Rs.	Rs. a. p.	Rs.
East Khándesh	200	200 0 0	72
Poona	225	...	720
Násik	250	250 0 0	216
Ratnágiri	250	...	216
Sátára	...	116 2 1	432
Sholápur	...	50 0 0	420
Ahmednagar	...	100 0 0	...
Thána	...	...	72
Bijápur	...	...	72
Kolába	...	...	72

The curriculum which was very much of an experiment at starting, on the whole has proved with modification in detail a considerable success. It involves, as was explained a year ago, at least half the working time being spent in farm work, or in gardening, in dairying or in other agricultural operations. The boys do practically all the work in the land allotted to their use, and they have almost entirely produced the food, except the grain and pulse used in the school. The school work, more properly so-called, consists of arithmetic, more especially including farm accounts on the one hand, and mensuration applied to agricultural purposes on the other, nature study largely taught practically; writing and reading, Geography of India, especially in relation to crops; the principles of agriculture, and two new subjects (1) village life, including sanitation, hygiene, and secondary occupations suitable for villages; and (2) what we call 'citizenship', which includes questions of how to obtain money by takavi, by co-operative credit, etc., and in addition, the system of local and village Government in this part of India.

The number of applications for admission to the school has been largely in excess of the number which we can receive, but they are subjected to a rigorous selection, and admission is only granted to those who belong to the classes which we want to have,—namely, those families who are themselves cultivators, or who are small land-owners where the boys are intended to devote this life to work in connection with the land. This rigorous selection results in considerable variation in the number admitted. There is always, moreover, a considerable leakage at first,—as the course is a hard and practical one, and unless a boy is ready to work on the land at what some consider menial occupation, he does not want to stop. It is, in my opinion, of course essential to maintain this tone if it is to serve the purpose for which it is intended.

The school has been visited frequently by gentlemen, by officers of the agricultural department, and by many of the parents and friends of the boys.

At the end of the school year in April 1913, the boys were examined by Messrs. S. L. Ajrekar, G. K. Ranade and V. G. Gokhale of the Agricultural College, and as a result eight certificates were granted to boys who had completed their two years' training. The examiners made remarks as follows :—

"*First year.*—The written examination of this class has brought out the fact that they are well up in Agriculture and nature study, the important subjects of the course, and have grasped well the general principles taught to them. Their dictation and arithmetic requires some more attention to bring them to the required standard.

They were quite proficient in the manipulation of the various farm implements at which they went in business-like way and also showed that they have a liking for the work they have to do in the course.

Second year.— The students of this class showed themselves in general better than the first year, as is expected. They have done very well in all the subjects both in theory and practice. Our impression of these students on the whole is that they have made themselves familiar with the existing methods of farming and also with their possible improvement and have acquired a training which will enable them to apply the elementary principles of Scientific Agriculture to the various agricultural practices they will have to follow on their own estates."

Mr. Gokhale who had been an examiner in the previous year, also made the following additional note :—

"I had an opportunity to be the examiner for the last two years and I am very glad to note that there has been a steady improvement in the methods of teaching, as judged from the results of the examinations. The efficiency of the school will, I hope, increase year after year as the staff gets experience and develop the method of teaching more by examples, practice and object lesson."

Twenty-three boys have now completed the course and been granted certificates. Most of these are farming on their own or other land. We are keeping as far as possible in touch with them, and it is hoped that they will become centres of influence in the future.

The accounts of the school are shown in the following statement. It will be noted that the ir David Sassoon Trust made a donation of Rs. 750 to the expenses of the school, which has considerably assisted the finances :—

Receipts.	Rs.	a.	p.	Expenses.	Rs.	a.	p.
1. Balance from 1911-12	450	0	2	1. Establishment ...	1,925	0	0
2. Poona Treasury (Government grant) ...	7,236	15	1	2. Boarding charges ...	2,803	3	11
3. Local Board grants ...	2,292	0	0	3. Purchase of live stock ...	96	0	0
4. Sale-proceeds of produce ...	158	2	0	4. Cultivation charges, making sheds, etc.	685	6	11
5. Sir David Sassoon Trust Fund ...	750	0	0	5. Feeding of stock ...	574	6	4
				6. Rent of school and sweeper charges	1,698	4	3
				7. School furniture and books .	199	15	6
				8. Oil	47	2	6
				9. Stationery and postage ...	94	1	0
				10. Tours of observation ...	19	2	0
				11. Travelling allowances to teachers	172	0	9
				12. Miscellaneous office expenses.	163	2	0
				13. Sale-proceeds of produce, as *per contra*, (sent to Poona Treasury)	158	2	0
				14. Balance in hand ...	2,251	2	1
	10,887	1	8		10,887	1	3

The fourth year of the school commenced on June 10th, 1913, in the same building (Kirkee Lodge) which was used during the third year. A large number of applications for admission were received, but these were rigorously weeded out, and seventeen boys were admitted, coming from districts as follows:—

Poona	5
Sátára	3
Sholápur	3
Násik	4
Belgaum	1
Thána	1

During the year progress has been made with the arrangements for transferring the school from Poona to a purely rural area at Lonikalbhar, where, as described in my last report, an area of twenty-nine acres of disforested land has now been acquired and where buildings for the permanent occupation of the school are being erected. These buildings will be complete and the school transferred in November 1913. The land is good, capable of irrigation when this is required, and appears eminently suitable for the purpose of the school.

The school is in my opinion now a decided success. It is appreciated by the parents of the boys, some of whom frequently visit it; it has attracted largely the class of boys for whom it was designed and I think it will ultimately lead the way to a class of rural education which will be of great advantage to the mass of the village population of the country.

HAROLD H. MANN,
Principal.

APPENDIX C.

SUMMARY OF THE WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, IN 1912-13.

1. The charge of the Deputy Director was redistributed during the year with effect from the 1st October 1912. The Karnátic and Konkan districts were allotted to the Assistant Deputy Director of Agriculture and the Extra Deputy Director of Agriculture, respectively, while Gujarát and Khándesh were retained in and the three North Deccan Districts of Poona, Ahmednagar and Násik added to the charge of the Deputy Director, making ten districts in all.

COTTON.

KHÁNDESH.

2. Considerable progress has been made in the organization required for the replacement of the present mixture of cottons by pure Roseum cotton. A large seed farm of 200 acres has been opened near Jalgaon and half of this will be sown with Roseum cotton in 1913-14. In addition to this, 13 cultivators have been registered as seed growers and supplied with Roseum seed to be sown in specified survey numbers (aggregating 362 acres *vide* margin) which have been inspected and approved of by the Department and a condition has been made that the Department shall have the option of purchasing back all the seed produced at the rate of 25 lbs. per rupee, the same rate charged for the seed supplied. In order that this seed shall not be adulterated with seed of other cotton types, special arrangements are being made to purify the crops and supervise the ginning. Apart from these registered growers some 10,000 lbs. of roseum seed was provided for distribution in 1913-14.

Places.	No. of cultivators.	Acreage.
		Acres.
Ráver	1	54
Yával	2	62
Nagardevla	2	80
Kadaki (Chálisgaon)	1	45
Pimpri (Dhulia)	1	80
Songir	1	53
Amalner	1	22
Khambala (Shirpur)	1	25
Málegaon	2	36¼
Tehere (Málegaon)	1	5
	13	362

3. Comparative experiments conducted at Dhulia between Roseum and other types found in Khándesh mixture have again resulted in favour of Roseum. The late rains were very deficient and the cotton crop suffered greatly from drought (in the Dhulia táluka it was practically a failure); nevertheless Roseum appears to have resisted the drought considerably better than the Jari types and this is in conformity with local opinion. The effect of this capacity to resist drought better than other types was to make Roseum relatively late in maturing in the season under report, as it retained its green colour longer and gave a smaller first picking than the other constituents of Khándesh mixture. Another point observed in favour of Roseum is that the bolls mature uniformly and open well, so that the picking of the seed cotton is much facilitated. Samples of the seed cotton of Roseum were valued in the Dhulia Bazar in February and March by two firms, including Messrs. Ralli Brothers, at 16 to 20 per cent. above the market rate of the day for Khándesh cotton. A feature of the season at Dhulia was the lower ginning percentages of all the types found in Khándesh mixture. Roseum only ginned a little above 34 per cent. and Vera 30½ per cent. This was apparently brought about by the drought.

4. The promising Hybrid Comilla **X** Bani referred to on page 28 of the 1910-11 report continues to do well at Dhulia and reached the F_3 generation in the year under report (owing to the failure of rains in 1911-12 little could be done and seed was held over). It is being carefully selected and a sample was valued by the Bombay Cotton Trades Association on the 10th April 1913 as under:—

> "Very fine in colour, not as good staple as Nos. 1 and 3 (Cambodia and Lalio samples grown at Nadiád), Value Rs. 335 per candy". (Basis of valuation Fine Broach Rs. 320 and Fine Navsári Rs. 345) which indicates that the sample was as good as Fine Surat. A sample of Roseum on the same day was valued at Rs. 275 per candy.

SOUTH GUJARÁT.

5. The arrangements for the cultivation and marketing of improved cottons* in the Surat district described in last year's report were continued. It was hoped to get a very large area put under these cottons, namely, 15,000 acres in British villages and 9,000 acres in Gáikwári villages and accordingly a large stock of seed was set aside for sowing this area while

* These cottons were grown on an area of 56 acres on the Surat Farm and gave an average outturn of 624 lbs. of seed cotton per acre with a ginning percentage of 33·4.

a substantial reserve was kept to meet the contingency of re-sowings which are so characteristic of this tract. Altogether 103 tons of seed were distributed in British villages and 66 tons were delivered to the Gáikwár authorities. Owing to the exceptionally heavy rains in July (amounting to nearly 40 inches) it was not possible to get the whole area, intended, sown; as a result of this rain only about one-third of the first sowings survived and of the remaining two-thirds about ½ had to be sown a third time and the sowing season was thus drawn out till the end of September. The actual area sown in British villages was approximately 11,000 acres distributed as shown in the margin, while the actual area sown in Gáikwári villages was approximately 6,000 acres. Although the abnormal climatic conditions at the opening of the season proved very embarrassing, the rest of the season right up to the time of harvest proved exceptionally favourable, the unexpected rain in the latter part of December sealed the success of the monsoon while the weather in the fair season was bright and opportune, dews fell at the time of boll-opening with the result that the cotton crop was exceptionally good in all respects including yield, boll-opening, colour and staple. So good was the cotton that the experts could scarcely distinguish between Sáyan and Navsári growths. In December-January the estimated outturns were—

Name of village group.	Area of cotton sown.
	Acres.
Bárdoli	2,579
Sáyan	2,198
Ránder	3,083
Athwa-Bhestan	3,085
Total ...	10,945

British villages	3,605 bales
Gáikwári villages	2,000 bales
Total ...	5,605 bales

and these yields must have been well exceeded.

6. So much for the Agricultural side of the work. The experience of working the scheme for marketing the seed cotton was a very different one. The Bombay Syndicate agreed to continue operations on the same lines as in the previous year, *i. e.*, to purchase the cotton at 5 per cent. above market rates for the ordinary local seed cotton and to sell seed to the Department at market rates for re-distribution.

All went well in the early part of the season but it was not long before a difference of opinion as regards rates arose between the Syndicate and the cultivators. The former based its opinion chiefly on Bombay Market Quotations. The Department pointed out, that in addition to the Bombay rate local factors influenced the rate paid for seed cotton in the mofussil and that there was no such thing in Surat as a fixed market rate, but that it varied from place to place. This is due to several causes of which the chief are :—

(1) Whether merchants dealing in "Futures" are buying to make good their contracts.

(2) Proximity to Navsári.

(3) An agreement or disagreement of a combination of traders. Thus a number of ginning merchants sometimes form themselves into an association and bind themselves not to gin any seed cotton for less than some high rate. A man who does not join such an association, if financially strong, can thus buy his seed cotton appreciably cheaper than the members of the association.

(4) The reputation of the village for producing a high class sample as regards ginning percentage.

(5) Whether cultivators are well versed in current market prices.

In this way sales are made on the same day at materially different rates.

The Syndicate however were not satisfied with the prices they were paying and suspended buying operations on the following occasions :—

First occasion, 20th—23rd February 1913,

Second occasion, 15th—24th April 1913,

and finally stopped again at the beginning of May and told the Department to make other arrangements for the sale of the seed cotton and they would pay 5 per cent. down on these sales. On the first of these occasions the market was disturbed by a breaking-up of a ginning association at Navsári, but the long period of suspension on the second occasion caused great embarrassment alike to the cultivators and the Department, for it coincided with a falling market.

7. The inference which I am inclined to draw from these experiences is that the Indian cotton trade, as at present organized, does not attach importance to relatively small differences (say 5 or 7 per cent) in the quality of the fibre. It is true that Navsári cotton is much better than Surat and that the trade pay 5 per cent. more for the former, but this seems to be more the result of custom than distinction between qualities; for when enterprizing men cart Surat cotton to Navsári and get it despatched from the latter station it is regarded in Bombay as Navsári cotton and priced accordingly. Under these circumstances the wisdom of devoting

time and money on the improvement of quality where this is only practicable within relatively small limits, and where abnormal seasons have a levelling effect, seems doubtful, and it is probable that the cultivators would be more materially benefited if attention were concentrated upon increasing the yield per unit of area and increasing the ginning percentage. In the mofussil a cotton having an improved ginning percentage commands a higher price more readily than a cotton with an equally improved staple.

8. Selection operations were continued at Surat on the same lines as in previous years and under the changed circumstances perhaps the most promising cotton is Selection I-A which gave an outturn of 832 lbs. of seed-cotton and a ginning percentage of 35. Selection II with a ginning percentage of 34 gave the high outturn of 1,107 lbs. of seed-cotton per acre. It is probable, however, that this yield was due to some favourable circumstances (which, however, was not detected) and that in point of yield there is not much to choose between Selections I-A and II. Selection I-A has been selected for ginning percentage since 1908-1909. The same cotton selected for quality during the same period gave a ginning percentage of 33 in the year under report.

9. The advantage of using good seed was well brought out in a comparative trial between Selection I and an ordinary local cotton, the seed of which was purchased in the bázár and was perhaps inferior to that usually sown by a careful cultivator. These cottons were sown in alternate 2 rows with the following results :—

Name of cotton.	Plot Nos.		Area in acres.	Average yield per acre in lbs.		Average value of produce per acre in rupees.	Average cost of production per acre in rupees.	Average profit per acre in rupees.	No. of plants per plot.
	Original.	Duplicate.		Seed-cotton (kapas).	Stalks.				
						Rs. a. p.	Rs. a. p.	Rs. a. p.	
Selection I ...	209	223	¼	689½	1,232	93 10 3	9 10 9	83 15 6	2,184
Local cotton ...	209	223	¼	311½	602	42 6 1	9 10 9	32 11 4	1,316

The higher yield and consequent greater profit per acre was chiefly due to the better germination resulting in a better 'stand' of plants in the proportion of 3 to 2 approximately, and the individual plants of Selection I were much more vigorous so that the rows of each were soon distinguishable and later in the season the contrast was very marked.

North Gujarát.

10. Cambodia cotton has done very well in the year under report. A crop which was sown in May with the aid of irrigation gave an outturn of 1,592 lbs. of seed-cotton per acre but in common with other cottons its ginning percentage was low in the season under report, being only 30·5 per cent. Buri cotton also did well with a yield of 1,056 lbs. of seed-cotton but the only serious rival to Cambodia is local Lalio which gave an outturn of 1,494 lbs. of seed-cotton per acre. Not nearly such good results were obtained with these cottons when sown at the beginning of the monsoon. The May-sown crop is ready for harvest much earlier than the monsoon-sown crop and thus stands less risk of being damaged by severe cold. Moreover, the young plants are sufficiently large by the time the 'katra' caterpillars arrive to survive the damage done by this pest, which wipes out the tender crop sown in the rains. Duplicate samples of these cottons were reported on by the Bombay Cotton Trades Association and Messrs. Tata, Sons & Co., as summarized as below :—

Name of variety.	Approximate market value in rupees per khandi of 784 lbs.		Remarks by	
	By the Bombay Cotton Trades Association.	By Messrs. Tata, Sons & Co.	The Bombay Cotton Trades Association.	Messrs. Tata, Sons & Co.
Cambodia ...	345	325	Bright, clean, good stapled cotton ...	Nadiád Farm appears to suit this cotton as all the characteristics of Cambodia are maintained. We recommend that special attention should be given to its cultivation at Nadiád.
Lalio ...	345	290	Better in class but rather harsher in staple than Cambodia.	The Nadiád soil suits the seed as the sample under inspection equals the best cotton grown in Baola (Gujarát District).
Buri ...	325	300	Rather seedy, fair staple, not as good in colour as Cambodia.	This cotton is after the style of Ghát Berar and we class it equal to Karkili.

Note.—The basis for the valuation taken by the Bombay Cotton Trades Association was—

	Rs.
Fine machine-ginned Broach	320
Fine machine-ginned Navsári	345

and by Messrs. Tata, Sons and Co. Rs. 305 and Rs. 345 for the same grades, respectively.

It will be noted that Cambodia is much preferred to Lalio by Messrs. Tata, Sons & Co., and evidently possesses a better staple than Lalio. About 1,000 lbs. of Cambodia seed was distributed in Northern Gujarát, mostly in Dholka Táluka of the Ahmedabad District, where Lalio is grown as an irrigated crop and there has been a huge demand for seed for sowing in 1913-1914. Indents for more than 20,000 lbs. of seed have been received, but, partly owing to the difficulty of getting seed and partly because it is considered desirable to still further test Cambodia against Lalio, only 2,000 lbs. of seed have been issued, mostly in small lots, so that trials will be made in a great diversity of places. This seed was obtained from Gadag from a good ginning lot of seed-cotton. Arrangements have been made to sow 6 acres with Cambodia cotton on the Nadiád Farm in 1913-1914 to provide seed and more *data* as to its real merits.

Dohad (Panch Maha'ls).

11. At Dohad in the Panch Mahals Roseum cotton did well and yielded upto 1,038 lbs. of seed-cotton per acre with a ginning percentage of 36·7 and appears to be the most suitable cotton for that locality.

CEREALS.

12. *Wheat.*—A comparative experiment has been conducted for the last six years at Dhulia to ascertain which of the two local wheats—Bansi (a hard variety usually confined to dry-crop areas) or Mundi (a soft variety usually grown on irrigated lands)—is the more profitable to grow where irrigation facilities exist. Apart from relative yielding capacities there are some five other considerations to be taken into account—

(1) the relative market rates of these varieties,

(2) the liability of a hard grained wheat to deteriorate by producing soft grain when irrigated,

(3) the relative feeding qualities of the chaff,

(4) the relative effects upon the rotation crop,

(5) susceptibility to rust.

As regards (1), a hard wheat ordinarily fetches a better price than a soft wheat, but, owing to a local demand for soft wheat at Dhulia, Mundi fetches a slightly higher price than Bansi. In practice it is found that Bansi does produce a certain proportion of soft grains, a disadvantage which could be kept within limits by importing fresh seed each year from a dry-crop area. The Bansi chaff has been analysed and found to be more than three times as rich in albuminoids than Mundi chaff, due probably to its greater production of leaf, while the succeeding crop of cotton has been markedly superior after Bansi than after Mundi to the extent of 150 lbs. of seed-cotton per acre on the average or 18 per cent. The general conclusion would appear to be that Bansi is a superior wheat to Mundi for irrigated lands, unless owing to some local demand Mundi commands a special selling price.

As regards susceptibility to rust, Bansi does not seem to be more susceptible than Mundi.

13. At Dhulia a comparative experiment was conducted on a small scale to test the effects of selection for a high number of spikelets during the past five years with the results noted below:—

Statement showing the number of spikelets produced by Bansi and Mundi wheats from selected and non-selected seed respectively.

No.	Name of variety.	Previous history of the plant selected.	No. of seeds sown.	No. of seeds germinated.	No. of ear-heads, possessing the following No. of spikelets, produced.																	Total No. of ear-heads produced.	Average No. of spikelets per ear-head.
					25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	
1	Mundi (selected)	1/23 1/24 1/21 1/24	150	145	13	30	72	132	149	256	175	115	46	110	19	20	9	8	6	...	...	...	1,100	19¼
2	Mundi (ordinary)	.....	150	121	...	25	33	84	52	95	103	90	135	140	110	120	30	40	...	8	...	...	1,060	17½
1	Bansi (selected)	1/20 1/19 1/23 1/21	150	146	...	...	...	2	36	117	155	201	81	48	26	11	1	...	...	...	...	...	678	19⅔
2	Bansi (ordinary)	.....	150	135	...	...	...	...	12	58	115	141	147	115	58	40	15	20	11	12	5	1	750	16¾

Note.—In column 3 the fractions represent the history of the selected plants in each season from 1908-1909 to 1911-1912. The numerator stands for the plant number and the denomination for the number of spikelets per ear-head of the plant.

14. The observation was made at Dhulia that the yield of wheat in some cases was considerably reduced by the prevalence of dry winds which blew in the first fortnight of February and caused the ear-heads to shrivel.

15. Selection work was continued on the same lines as in previous years at Dhulia, Dohad and Nadiád.

16. *Bájri.*—At Dhulia experiments shew that bájro (Bhávnagar bájri) is too late in maturing to suit Khándesh as it fails to produce grain in a year of deficient late rains whereas local bájri under the same conditions will produce a small crop.

17. *Jowár.*—Similarly jowár is a precarious crop to grow at Dhulia and fails to produce grain in a season such as the one under report.

18. Selection on this crop was continued at Surat on the same lines as in previous years.

19. *Rice.*—At Dohad very good results were obtained with paddy. The crop was grown according to the transplantation method as a demonstration and the Sutarsal variety yielded upto 3,440 lbs. of grain per acre on a well-manured plot. Kamod also did well and left a profit of nearly Rs. 60 per acre exclusive of rent and taxes.

OIL-SEEDS.

20. *Groundnuts.*—Good results were again obtained with this crop (dry) at Dohad—in a wet season—which confirms the observation made in last year's report that this crop does well under very divergent rainfalls, but it is susceptible to much damage if there is drought at the time of flowering as happened at Dhulia in the year under report because this causes the plants to shed their flowers.

21. *Til.*—Experiments conducted at Dhulia have brought out the very precarious nature of the til crop. The average outturn per acre of this crop for the last five years excluding (1911-1912) has been 394 lbs. of grain, but the maximum was 804 lbs. in 1908-1909 and the minimum 114 lbs. in the year under report in which the crop suffered severely from drought in September; the former has exceeded the latter by seven times.

PULSES.

22. *Tur.*—Experiments on tur at Surat indicate that the character of white-coloured pods is transmitted true to type in the absence of cross-fertilization, but with regard to the other colours—black and mottled—further observations are required. This crop is not usually grown pure but an experiment was conducted at Dohad in which Nadiád tur, dibbled 3′ × 2′ (probably too close), was grown as a pure crop. It gave a yield of 1,420 lbs. of grain and left a profit of Rs. 34 per acre exclusive of rent.

TOBACCO.

23. The experiment of growing white Burley tobacco on a large scale has turned out well. The yield of cured leaf per acre was 1,845 lbs. This was barn-cured and a good colour and a fine aroma were obtained. Samples were sent to two tobacco companies for their opinions. Unfortunately these differed greatly as regards money valuations. The British Tobacco Company of Lahore have prepared cigarettes and intend to place them before the smoking public, but they state that the Punjab tobacco is superior and they only offer Rs. 6 per maund of 82 lbs. for the leaf, whereas the local country-grown tobacco (sun-cured) fetches not less than this rate in the Nadiád bázár. The Indian Leaf Tobacco Development Company, Limited, of Calcutta, on the other hand submitted a much more favourable report, from which the following is an extract:—

> "The writer has examined the samples carefully and wishes to congratulate you on the texture and flavour of the White Burley varieties. The colour of the 'Flat Hand-folded' samples is also very good. It is difficult for us to advise you just what the intrinsic value of these tobaccos are; however, we should say that we would be very glad to offer you as much as 8 to 10 annas per pound for the brightest samples of White Burley above referred to."

A sample of barn-cured Cavalla (a Turkish variety) was not well reported upon. No marked results have been obtained with potash manuring to increase the contents of potash in the leaf of tobacco produced at Nadiád.

FODDER CROPS.

24. *Emergency fodders.*—In the famine of 1911 a considerable number of cultivators in Northern Gujarát came to the Department, asking to be supplied with lucerne seed, and it was very difficult to obtain seed to meet these indents. Seed was obtained, however, from the marginally noted sources and altogether 400 lbs. were distributed. In the year under report (1912-1913) there was a further demand and some 328 lbs. of seed was distributed.

* Quetta ... 5 lbs. per rupee.
Ráwalpindi... 4 lbs. per rupee.

25. As lucerne is an expensive crop, to produce it was difficult to see how cultivators were going to make a good thing out of its cultivation on deep wells (50 to 60 feet deep). It was therefore decided to conduct an experiment in order to ascertain the possibilities of this crop as an emergency fodder. Accordingly small areas were sown on the Nadiád Farm at intervals of one fortnight from the 15th October to the 15th December inclusive with the results noted in the statement below, from which the following observations may be made:—

---

* The best time to obtain seed from Quetta is September to October. A reliable firm is Shet Gurditan Das Baramal, Shop No. 6, Moohi Bázár.

(1) The best time to sow seems to be between mid-October and mid-November. There is no objection to sowing later than this except that there is a shorter period in which the crop can grow before the next rains and therefore a smaller aggregate return of produce which costs proportionately more.

(2) In a hot dry year when the rains fail it is unlikely that lucerne would do well if sown before the cold weather set in. If sown between 15th October and 15th November, a yield of 28,400 lbs. of green fodder may be expected in four cuttings before the 15th May, costing 130 lbs. per rupee to produce; if sown later than the 15th November the cost of producing 100 lbs. may exceed a rupee.

(3) Fourteen to 19 irrigations are required even when the preceding monsoon has been heavy and the outlay per acre is seldom less than Rs. 200.

(4) The first cutting may be expected after 10 weeks; this is when the crop is in flower, but an earlier cutting could be obtained. After the first cutting second cuttings can be had at intervals of about 5 weeks if the crop is allowed to bloom.

(5) Sowing on ridges appears to be preferable to sowing on the flat in beds.

(6) For a cost of one rupee 130 lbs. of green lucerne can be raised, which is enough to maintain a pair of cattle for ten days, if it can be supplemented by any sort of coarse fodder such as inferior grass or tree leaves.

LUCERNE.

Area of plot in gunthás.	Date of sowing.	No. of irrigations given.	Yield per acre in lbs. upto 15th May.	No. of cuttings obtained.	Distribution of cuttings in days.	Cost of production per acre in rupees.	Cost of production in lbs. (green per rupee).	Remarks.
						Rs. a.		
5	15th October* ...	19	28,618	4	71—61—39—39	222 5	129	
2½	1st November ...	17	23,560	4	88—19—25—61	232 5	123	The lucerne was sown on ridges by hand.
2½	15th November ...	14	29,072	4	83—46—26—24	208 0	140	
2½	1st December ...	14	19,344	3	104—35—24	214 0	90	
2½	15th December ...	11	12,888	3	99—26—24	180 0	72	

* On the same day a plot was sown by a drill but did not germinate. A third plot was sown in beds and yielded 23,144 lbs. per acre.

26. Trifolium Alexandrium (Berseem) on the other hand did not do well, due apparently to the land being too sandy and not retaining sufficient moisture between irrigations.

27. At the same time similar experiments were conducted with Sundhia jowár in the latter half of the rains and with millets—Cheno (Panicum miliaceum) and Kang (Setaria italica)—in the cold weather but it was found that neither of these millets are cheap irrigated fodders. Thus Cheno cost 64 lbs. per rupee to produce while Kang cost 84 lbs. per rupee. The average 'dry' outturn per acre was 2,960 lbs. in the case of Cheno and 5,158 lbs. in the case of Kang but Kang took longer to mature than Cheno in the proportion of 81 to 64 days. These millets can be safely sown any time up till Christmas. Sundhia sown in the middle of August gave an outturn of 5,000 lbs. (dry) fodder, costing 427 lbs. per rupee to produce, and did not require irrigation, but when this crop was sown in September and October and irrigated it did not do so well.

28. In practice the best course to adopt would seem to be, when the famine or scarcity makes its appearance, to put in Sundhia and to endeavour to get the seed sown before the end of August. Later on, when the exact nature of the shortage in fodder can be estimated, lucerne should be sown on ridges as soon as the cold weather sets in and by preference not later than the middle of November.

29. Cheno and Kang cannot be expected to yield before the middle of December and hence are scarcely worth growing as the cost of production of 1,000 lbs. (dry) amounts to Rs. 12 to Rs. 15 and the crop is ready very little earlier than lucerne, *i. e.*, not till the middle of December, when imported grass may be expected, but if it is decided to sow a cereal in the cold weather, then Kang appears to be the most suitable and may be expected to yield upto 5,000 lbs. of (dry) fodder per acre if sown before the middle of December.

30. *Berseem.*—At Dohad Berseem grown in paddy fields after the paddy was harvested did very well and gave a yield of 34,451 lbs. of green fodder per acre worth locally Rs. 86 and costing Rs. 33 to produce which could be reduced as a part of the field was sown without any preparatory tillage and did well.

FEEDING EXPERIMENTS.

31. Feeding experiments conducted at Surat indicate that heavy Gujarat bullocks weighing 1,150 lbs. can be maintained in good condition on 17 lbs. chaffed kirbi per head or 19 lbs. of whole kirbi, plus concentrates amounting to some 2½ lbs. when engaged on light work.

32. Cotton hulls were used for the first time in the year under report with satisfactory results. Bullocks of the weight mentioned above can be maintained in good condition on light work when fed with 20 lbs. of hulls as the sole fodder plus 3 lbs. of concentrates. The hulls cost Rs. 11-14-6 per 1,000 lbs. delivered at Surat from Navsári.

ROTATIONAL EXPERIMENTS.

33. Experiments have been conducted for the last six years at Dhulia to ascertain the most profitable rotation crop for cotton and to ascertain whether cotton could be profitably grown for several consecutive years on the same land. The following statement summarizes the results obtained with different rotation crops:—

Name of crop grown in a two-year rotation with Cotton.	Average yield of seed cotton per acre for the five years 1908 to 1912 excluding 1911 a year in which the rains failed.	Average profit in rupees per acre per rotation.
Fallow	932	50½
Udid	829	50½
Til	875	68½
Bájri	753	62

34. It will be noted that the yield of cotton has ruled very high on all plots but highest on the fallow rotation plot while the til rotation has left the greatest margin of profit. The bájri rotation however comes pretty near to til in point of profit and bájri must be grown to supply food to men and fodder to cattle.

35. Cotton grown continuously since 1907-08 (excluding 1911-12 when no crop could be taken) on the same land has yielded as follows:—

Treatment.	Average yield of seed cotton in lbs. per acre.	Average profit in Rs. per acre.
Land ploughed with country plough but never manured ...	509	43
Land ploughed and manured at the rate of two tons of farm yard manure per acre per annum	593½	44

36. With regard to kharif lands in Khándesh we may therefore infer that:—

(1) Cotton can be safely sown for more than one season on the same land,

(2) Bájri (or jowár if the land is retentive and the rainfall good) should be the chief rotation crop,

(3) A limited area of the holding should be cropped with til or perhaps groundnuts.

37. An experiment was conducted at Surat to ascertain whether in a rotation of cotton and groundnuts it is better to grow these crops alternately or simultaneously in strips 6 feet wide, with the following results:—

Item.	Two-year cotton groundnut strip rotation.	Two-year cotton groundnut separate rotation.
Profit per acre in Rs.	87 13 8	55 9 10
Yield of seed cotton per acre of holding in lbs.	425·0	242·5
Yield of groundnuts per acre of holding in lbs.	970·0	822·5
Yield of groundnut Bhusa per acre of holding in lbs. ...	3,887·5	2,825·0

which indicate that much better returns can be obtained by the strip method.

38. A second experiment designed with the object of seeing whether groundnuts could be introduced into the rotation of cotton and jowár (plus pulses) usually adopted in the Surat district was conducted. In any rotation in Surat district it is essential to provide for the production of as much cotton as is at present produced, because it is the money-making crop of the tract. On the other hand fodder is scarce and it is undesirable to reduce the supply of it. The following was therefore laid out, keeping these points in view:—

1st year—jowár (with tur).

2nd year—cotton cum groundnuts.

3rd year—groundnuts cum cotton, and this was compared with the local rotation with the following results:—

Name of crop.	Yield in lbs. per acre of holding.		Remarks.
	Local rotation.	New rotation.	
Seed cotton	265	317·5	It will be noted that the fodder produced per acre of holding is— Local Rotation ... 760 lbs. New Rotation ... 3,593·6 lbs.
Jowár grain	133·7	109·2	
Tur grain	20	43·3	
Groundnuts	*Nil.*	651	
Jowár-kirbi	652·5	437	
Tur Bhusa	175·5	218·3	
Groundnut creepers ...	*Nil.*	2,938·3 *	

* Semi-dry.

The profit per acre of holding works out at—

Local rotation Rs. 36-8-6.

New rotation Rs. 69-1-6.

39. Experiments at Nadiád to investigate the advantages of mixed cropping which is so characteristic of North Gujarát gave interesting results in the year under report. Comparative plots were sown with Bájri mixture and the different constituents of this mixture sown separately on sections of the plot proportionate to their importance in the mixture. The same was done in the case of Kodra mixture and Bavto mixture. In all cases the principal crop gave a heavier outturn on the plots sown with a mixture; the results obtained with the subordinate crops of the mixture are not so decisive but in all cases the value of the produce from a given area has been greater with mixed crops than with pure crops while the cost of production was the same. The great advantage about mixed cropping is the security which is given to the cultivator. If conditions are unfavourable to one constituent they may be favourable to the other constituents of the mixture which take advantage of the extra space.

40. In Khándesh experiments have proved that Udid cannot be relied upon as the sole crop of the kharif season as it is liable to completely fail in an unfavourable year such as the one under report when the September rains failed. The average yield of this crop for the last five years (excluding 1911-12) has been 269 lbs. of grain per acre but the maximum was 731 lbs. in 1910-11 and the minimum nil in 1912-13. Udid is accordingly usually grown as a subordinate crop with one of the staple crops.

41. An experiment was conducted at Dohad to ascertain whether paddy plus some rabi crop is a more profitable system of cropping than maize followed by wheat, where irrigation facilities exist. In the year under report wheat was also taken on the paddy land in the rabi season. The results should be taken with caution but apparently favour maize-wheat which left a profit of Rs. 84 per acre against Rs. 27 by rice-wheat.

42. Another experiment conducted at Dohad had for its object to ascertain whether a mixed crop of maize and tur is more profitable than maize followed by gram. In the latter case rabi cultivation is required which adds to the expense. In the year under report the results favour maize plus tur which left a profit of Rs. 76 per acre against Rs. 55 left by maize followed by gram.

MANURIAL EXPERIMENTS.

43. At Surat the experiment in which several kinds of bulky manures are being tested, in order to ascertain suitable substitutes for farm yard manure, proved very

interesting in the year under report. The chief results are summarised below which speak for themselves :—

Manurial treatment at the rate of 5 tons per acre.	Average yield of seed cotton in lbs. per acre.	Average value of produce in Rs. per acre.	Average cost of production in Rs. per acre.	Average profit in Rs. per acre.
No manure	452	61	11	50
Farm yard manure	642	87	24	63
Mohra refuse	752	105	19	86
Poudrette	935	127	25	102

Note.—These figures are given to the nearest pound and rupee.

44. Similar results were obtained with the jowári crop grown in rotation with cotton from the residual effects of the manures applied to that crop in 1911-12.

45. At Surat night soil applied at the rate of 30 tons per acre in the hot weather of 1911 has resulted in a yield of 1,177 lbs. of seed cotton (the third crop since its application) per acre worth Rs. 160, while on the rotation plot the jowár crop was injured by a storm in November but gave an outturn of 810 lbs. of grain and 9,213 lbs. of kirbi per acre worth Rs. 176.

46. An experiment was conducted at Dohad in which the total dung voided by a given number of cattle in a given time was applied to the maize crop, while the total urine passed in the same time by the same cattle and absorbed in earth, was applied to another plot of equal size. The results obtained are tabulated below from which it will be seen that the urine has given substantially better results than the dung :—

Manure applied in lbs. per acre.	Yield per acre in lbs. of grain.	Profit in Rs. per acre.
7,476 of Dung ...	2,012	33·8
11,396 of urine earth ...	2,272	43·2

47. At Surat artificials such as calcium nitrate, sodium nitrate combined with superphosphate, and nitre have given good results on cotton and the nett profits would in some cases have been higher if the crop had not required to be resown.

TILLAGE AND CULTURAL EXPERIMENTS.

48. An experiment has been conducted for 4 years on the Dhulia Farm to ascertain whether there is any advantage in inverting the soil with an iron plough over stirring (or grubbing) it with the local country plough, on clean land, the soil being medium black. For this purpose the land was ploughed once in two years in the fair season before cotton; the rotation crop was juar for which the land was only harrowed. On an average of 4 years cotton had not appreciably benefited from inverting the soil but during that period there have been two good years and two bad years; in the former a greater yield has been obtained from the country-ploughed plots while in the latter the reverse has been the case indicating the value of thorough and deep cultivation as a means of protecting the crop in a droughty year ; the actual results are tabulated below :—

Nature of season.	Yield per acre in lbs. of seed cotton.	
	Inverting with an iron plough.	Stirring with a country plough.
Two good years 1909-10 and 1910-11	501¼	564⅜
Two bad years 1908-09 and 1912-13	251¼	171⅜

49. Perhaps the most interesting fact brought out by this experiment is the (consistently) beneficial effect of inverting the soil on the rotation crop of jowár in the following season as may be gathered from the following figures :—

Average increase obtained with jowár from the plots which were ploughed with an inverting iron plough over those ploughed with a country plough in the previous season before cotton.

In lbs. per acre.		In profit per acre in Rs.
Grain.	Kirbi.	
Lbs. 149	Lbs. 955½	Rs. a. p. 13 4 0

50. Therefore if we consider the matter from the point of view of the rotation as a whole, we see from the figures below that there is an advantage of nearly Rs. 5 per acre in favour of ploughing the land with an inverting iron plough :—

Treatment.	Average profit in Rs. per acre per rotation.
	Rs. a. p.
Inverting the soil with a CT_2 plough ...	27 10 9¼
Ploughing with the country plough ...	22 12 10⅛

51. At Surat the experiment of ploughing clean black cotton soil with an inverting iron plough has not yielded definite results in the year under report, owing to the damage done to the crop sown in July by excessive rain necessitating a second sowing in mid-August.

52. An experiment designed to ascertain whether ploughing clean black cotton soil with the country plough after the rains break is to be preferred to the practice of harrowing only, has been carried on for the last five years at Surat, but the general conclusion arrived at is that ploughing under such circumstances is unnecessary as no marked effects have been produced on either of the crops cotton and jowár.

53. Experiments in dibbling cotton on heavy black cotton soil at Surat on hillocks prepared in the hot weather have resulted in increased yields but not sufficiently so as to cover the extra expenditure.

IMPLEMENTS AND MACHINERY.

54. In the course of the year a new French Bajac plough was obtained from France for use in Gujarát. Full details will be found in the Surat Report for 1912-13. The plough is a 2-gang one and the cost of the complete plant landed in Surat plus local accessories including bullock yokes amounted to Rs. 3,911. The Department purchased 4 pairs of cattle costing Rs. 1,522 to work the plant and contract work was undertaken from the middle of January till the end of May during which time 42 acres were ploughed in 125 working days, including time spent on transporting plant and petty breakdowns. The rate charged was Rs. 20 per acre but this will have to be materially increased in order to make the enterprize a financial success.

ERICULTURE.

55. Experiments were conducted on a large scale at Nadiád but great mortality took place among the worms in the cold weather and also among those hatched out in March. In both cases the worms began to die after the second moult and scarcely a cocoon was obtained from two broods of 2 and 5 lacs of worms respectively. Samples of the dead worms were sent to Pusa and the report stated that the worms had died of a kind of "Flacherie" induced by indigestion.

The conclusion to be drawn from these experiments is that ericulture is too precarious an enterprize to be worthwhile undertaking in Gujarát. Moreover the rearing expenses of 11½ annas per pound of pierced cocoons, although the leaf cost nothing, in the case of those broods in which the mortality was low, are too heavy to permit of a profit being realized, as 12 annas per pound is difficult to obtain for the pierced cocoons.

PREVENTIVE ENTOMOLOGY.

56. Jowár borer (Chilo simplex) did an immense amount of damage to the jowár crop on the Surat Farm. This pest first appeared in early August and in some cases the crop was so badly damaged as to reduce the yield to less than one-half of what it otherwise would have been. The best treatment to adopt is to cut off the attacked stems at a point of 1 to 2 inches above ground level and bury them in a pit under earth.

GENERAL DISTRICT WORK.

Name of place.	Date.
1. Jhálod (Panch Mahals)	3-11-12.
2. Hálol (do.)	5-1-13.
3. Broach (Broach)	6-7-11-12.
4. Wágra (do.)	17-11-12.
5. Shuklatirth (Broach)	24-11-12.
6. Jambusar (do.)	19-1-13.
7. Athwa Farm (Surat)	1-12-12.
8. Pardi (do.)	5-12-12.
9. Aslali (Ahmedabad)	12-12-12.
10. Bavla (do.)	16-12-12.
11. Do. (do.)	16-17-1-13.
12. Harsol (do.)	20-12-12.
13. Ahmedabad	11-15-2-13.
14. Kapadwanj (Kaira)	26-1-13.
15. Dhulia (West Khandesh)	24-26-12-12.
16. Dhamangaon (East Khándesh)	28-10-12.
17. Sávda (do.)	15-11-12.
18. Bahal (do.)	20-4-13.
19. Chandanpuri (Násik)	22-1-13.
20. Nimbgaon Davdi (Poona)	20-4-13.

57. There were 20 organized† demonstrations in Gujarát and in Khándesh and the North Deccan in the year under report at the marginally-noted centres. These were carried out on the same lines as in previous years and produced considerable effect.

58. In addition to these, arrangements were made to carry out demonstrations in villages extending over a period of time. Thus in the great wheat growing tract known as the Bhal, in Dholka Táluka of Ahmedabad district, the Olpád threshing machine was demonstrated. This machine was kept at work for 24 days in 14 villages and the wheat of 19 cultivators was threshed out. Altogether 2,000 maunds (40 lbs. make one maund) of grain were so threshed, and the work done in a day of 8 hours varied from 50 to 75 maunds of grain requiring one pair of bullocks and 3 men. In the local method of threshing the grain out under the feet of bullocks at least 16 bullocks and some 5 or 6 men are required to do the same work. As a result of this demonstration some of the cultivators desire to get these machines locally prepared.

59. Another very valuable demonstration was given in Broach district in co-operation with the local Agricultural Association. This was a demonstration on a vast scale of the value of steeping jowár seed in a solution of copper sulphate as a preventive of smut disease. In this district considerable damage is done every year to rabi jowár by smut which is very prevalent. This disease is particularly bad in the kárá villages of Wágra táluka. For about 20 days three fieldmen travelled separately from village to village conducting the work. The results obtained are tabulated below and speak for themselves :—

Name of táluka.	Area in acres sown with steeped Jowár.	Percentage of smut in steeped fields.	Percentage of smut in unsteeped fields.	Remarks.
Wágra	21,682	½ to 2*	12 to 25	* In four villages only.
Ankleshwar and Hánsot .	1,262	*Nil.*	12 to 33	
Broach	832	½*	12 to 33	* In one village only.
Jambusar	437	*Nil.*	*Nil.*	

It will be noted that in unsteeped fields the percentage of smutted earheads amounted to as much as 33 per cent; the contrast could be readily made out in the standing crop where two fields sown with steeped seed and one with unsteeped seed were situated on adjoining areas.

60. In Ahmednagar, where there was a famine in the year under report, a demonstration in the maintenance of cattle upon prickly pear was conducted at Ahmednagar itself and afterwards at Lákh a typical affected centre.

At the end of March eleven small Deccani bullocks which had been reduced to mere skeletons and which would have been sold to butchers were purchased for the lump sum of Rs. 164-8-0 at Káhuri and Walki. They were sent to Ahmednagar and their average weight on the 6th April was 309 lbs. per head. They were fed at first on 5 lbs. of prickly pear plus 2½ lbs. of dry grass plus 2½ lbs. of kirbi plus one-third pound of cotton seed per head per day.

61. On the 12th April these cattle were transferred to Lákh as being a better centre for demonstration and were kept there till the end of June, during which time they were fed

† By an organized demonstration is meant a demonstration the date of which is arranged in advance and district officers are asked to co-operate.

principally on prickly pear containing 6 per cent. of cotton seed and about 3 lbs. of dry grass per head per day. In the middle of May their ration was 28 lbs. of prickly pear, 1½ lbs. of cotton seed and 2 lbs. of dry grass per head per day, but for some time they got 2¾ lbs. of cotton hulls in addition. At the end of June they were transferred to Ahmednagar and again weighed (30th June) when the average weight had gone up to 322½ lbs. per head and an oil monger offered Rs. 200 for the lot.

62. The preparation (including cutting, carrying, burning and chaffing) of the prickly pear cost Rs. 4 per 1,000 lbs. but this could probably be reduced to Rs. 3. Hay was sold by Government at the reduced rate of Rs. 10 per 1,000 lbs. and jowár kirbi imported from Barsi and other villages in Sholapur district was sold at Rs. 20 to Rs. 25 per 1,000 lbs. by contractors.

63. In addition to these Government cattle a large number of cultivators' cattle (reaching a maximum of 468) were brought to the Lákh Camp and these were given a daily ration of about—

4 lbs. kirbi
2 lbs. dry grass
2 lbs. of cotton hulls, plus some
6 lbs. of prickly pear, plus
¼ to ½ lbs. of cotton seed

per head per day and the cattle, apart from 3 epidemic diseases, did well and improved in condition. During the last 25 days the cows were kept solely on prickly pear and they throve on it. About 2,500 lbs. of prickly pear was prepared daily at the Lákh Camp.

64. Demonstrations of the Poona furnace used in gul making were given at a number of centres in the North Deccan and Khándesh.

65. Several members of the Broach Agricultural Association placed plots of land at the disposal of the Department for giving demonstrations. Unfortunately the floods in July spoiled several of these plots. A successful demonstration however was given of growing cotton and groundnuts in alternate strips at Tham in Broach táluka, the yield of produce amounting to 262 lbs. of seed cotton and 823 lbs. of groundnuts worth Rs. 91. On another plot a pure crop of groundnuts yielded 1,629 lbs. of nuts and 4,369 lbs. of creepers per acre worth Rs. 102.

T. F. MAIN,
Deputy Director of Agriculture,
Bombay Presidency, Poona.

Poona, 18th July 1913.

APPENDIX D.

SUMMARY OF WORK DONE BY THE ACTING DEPUTY DIRECTOR OF AGRICULTURE IN CHARGE SOUTHERN DIVISION.

Staff.

The Southern charge as newly constituted comprises five districts in which are situated three Experimental Farms and four Sub-stations and one Grazing Farm. In the districts of Dhárwár, Belgaum and Bijápur the organization of the Staff remains unaltered. A Superintendent is in charge of each Farm, and a Divisional Inspector controls the work outside the Farm. Both have Overseers, or Fieldmen under them. In Sholápur and Sátára there are no large Experimental Stations and all work in these districts is under the immediate control of the Superintendent, Nadiád Farm, on Special duty. The management of these small Experimental Plots, designed for special purposes, and the ordinary duties of a Divisional Inspector, are undertaken by this Officer, with the help of 4 Overseers.

Nature of Work.

On the Experimental Farms little alteration has been made in the programmes. The majority of the areas are occupied by permanent experiments laid down some years ago. These experiments are of the nature which requires the cumulative evidence of many years' results, before any final interpretation can be attempted; and any change in their scope must obviously be as a general rule undesirable, unless such change can be effected in concordance with the possibility of comparing one year's results with another's. Details of experimental work are given in the annual report of each station, and need here be given only passing mention.

On the Dhárwár and the Gadag Farms, special attention is paid to cottons; problems regarding their manurial and cultural treatment, their improvement by selection and by cross-breeding and regarding the introduction of new cottons are under investigation. Similar enquiries relating to other staple crops also form an important part of the Farm Programmes. Again on the Gokák Farm, irrigated crops are under observation and experiment.

The introduction of Broach and Cambodia and Kumpta cross cottons into the Southern Mahratta Country is the result of a series of investigation on the Farms, the work is developed by the District Staff, while the Farm Staff continues to deal with problems of more or less importance, such as must usually arise in connection with any improvement, involving changes, however small, in the cultivator's routine, a new habit for the crop and the like. Broach and Cambodia cottons to a value of Rs. 1,09,400 and Rs. 85,300, respectively, were received for auction; the top lots of each realized Rs. 200 per Naga (1,344 lbs.), corresponding local cottons being worth on the same day Rs. 138 and Rs. 140.

To turn specially to the work of the district Staff. Demonstrations, seed, implement and manure distribution, the collection of agricultural information occupy their attention at different times in the year. Demonstrations for special purposes were conducted, in suitable places and usually were attended with success, orders for the object of demonstration being frequently registered on the spot. Iron ploughs, the Gujarát Harrow for uprooting cotton stalks, the Olpád wheat thresher, and the Poona improved Gul-boiling furnace were received with favour, copper sulphate as a preventative of jowár smut was widely advocated.

Poona Gul-furnace demonstrations resulted in several applications for an expert builder. The single, double, triple, and multiple furnaces all have their advantages according to the quality of cane to be crushed. In the Southern Mahratta Country the single furnace will probably be the most generally useful. In three centres in Belgaum District, the time taken for one boiling on local furnace ranged from 4 hours, 45 minutes to 3 hours, 40 minutes, on the Poona single furnace was 3 hours, and on the double furnace 2 hours, 5 minutes to 1 hour, 50 minutes; the relative amount of fuel required per day for equal quantities of Gul was (1) 39 to 42, (2) 20 to 19, (3) 15 to 13. These figures speak for themselves. At Sholápur a multiple furnace was erected on a large estate, where a power crusher is employed. Sixteen local furnaces have previously been used to cope with the daily output of 24 pans of juice. The owner has decided that two multiple furnaces will be sufficient; the saving in labour and in fuel will be enormous.

Before leaving the subject of sugarcane, the great popularity of ammonium sulphate as a manure may be mentioned, 21 tons were imported and the majority sent to Sátára District, where orders for the whole supply were booked in a few days. This is largely the result of small demonstrations undertaken by cultivators to whom the manure was previously supplied free.

Iron ploughs and other improved implements are gaining in popularity and those sold in the Southern Mahratta Country by the District Staff totalled in value Rs. 1,830. This figure is not inclusive of implements sold direct from the Farm or by Agricultural Associations. The Bajac plough does very good work, and the receipts under the system of working adopted this year leave a small margin of profit. The work was undertaken by the Department who supplied all labour and charged Rs. 35 per acre. Experience has shown that certain economics could be effected in the working, and at the same rate, and given the same amount of work, a maximum profit of 6 per cent. on the outlay on plant and bullocks might be realized due and ample allowance having been made for depreciation.

In the work of distributing seed, the activities of the Department increased. Seed of cotton, ground-nuts, and potatoes was collected in considerable quantity, careful attention being paid to its quality, and subsequent storage. Concession rates were granted to newly established Seed Societies and Associations.

Some Associations are doing good work in the distribution of seeds and implements. One at Kurtkoti made it their special duty to obtain a supply of pure seed of Cambodia cotton; the Bijápur Association devotes its attention largely to the sale of iron ploughs. Some members of the Dhárwár Association do good work in devoting a portion of their land to demonstration plots, thus bringing the Department's work to the notice of the cultivators who would not otherwise be easily within reach of the influence of the large experimental farms. Sholápur, Bársi and a number of small Táluka Associations in Sátára District are active in various directions and the Belgaum Association is showing renewed life.

Amongst enquiries which have been undertaken, three may be mentioned. Groundnut is a very important crop: in parts of Sholápur and Sátára Districts foreign varieties which are principally cultivated were reported to be deteriorating in quality, and to have a deleterious effect on the succeeding crop. Evidence, widely collected, confirmed these allegations, and afforded tentative explanations which are to be tested on an experimental plot specially leased for the purpose.

Further attention was paid to the tracts suitable for the various cottons recommended for introduction in the Southern Mahratta Country, and the areas are now fairly well defined.

Some figures connected with sugarcane in the Southern Mahratta Country were collected, and tend to show that the quality of cane is as good as that of Pundia grown near Poona, but that improvements in methods of planting and of irrigation are desirable.

The Tegur Cattle Farm and the experimental plots in Sholápur and Sátára Districts are not reported on elsewhere and their working is briefly referred to below.

Tegur Cattle Farm.—An area of 220 acres has been almost cleared of scrub growth and is stocked with 19 cows and one heifer of the local breed, and a stud bull from Mysore. Calves number 17; at the close of the year there were none by the Mysore bull. A quantity of grass is cut and stacked, keeping sufficient in reserve for a bad season. The reaper used does good and cheap work.

Proper care of young stock, the improvement of the local breed, and the rational management of a grazing farm are the objects of this Station.

On the Bársi plot, cotton and jowár varieties are grown, artificial manures are compared, and the benefit of careful interculture and of steeping jowár seed in copper sulphate, is demonstrated. Khándesh cotton (Roseum) in a season of poor rainfall yielded 556 lbs. seed cotton per acre, ginning 38 per cent., and was the most successful of the varieties grown. Of manures on cotton ammonium sulphate alone has done well, whereas superphosphate alone, and sulphate of potash alone had no effect on the yield. Groundnuts were grown but were not successful owing to lack of rain.

At Bhilawadi cotton and jowár are grown in rotation. Five varieties of cotton are compared with the local Kumpta and the question of time of sowing is being investigated. One variety of jowár is cultivated, and seed treated and untreated for smut is compared. The treated seed gave a better yield by about 300 lbs. grain and 1,000 lbs. fodder per acre than the untreated.

T. GILBERT,

Deputy Director in charge,

Southern Division.

APPENDIX E.

SUMMARY OF WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE IN SIND, 1912-1913.

Season.—From the inundation point of view the season has been an unsatisfactory one. River Indus rose later than usual and failed a month earlier. The result was that kharif crops were adversely affected in Upper Sind and on inundation canals in Lower Sind.

Fodder was however plentiful and cheap. This was due to the larger area having been put under quick growing—cereal crops partly owing to the lateness of the inundation season and partly on account of previous years' dearth of fodder. Rainfall was a little higher than the average but was chiefly confined to Lower Sind. No frost occurred during the year and cottons continued yielding practically throughout the whole of cold weather.

General Condition of Agriculture in Sind.—It will simply be a repetition of what has already been stated about the extremely backward condition of Sindhi agriculture in general. The fact has remained so in spite of the tempting advantages offered by improved irrigation facilities, better prices for the outturns and the growing necessity for feeding more mouths. The very fundamental principle of ordinary cultivation is disregarded and it is a common sight to see fields full of weeds and jungle at the expense of cultivated crops. The Sindhi has very ineffective tillage implements incapable of doing anything beyond scratching the soil. He has further a very limited number of crops, which, besides encouraging in a bad year insect and fungus pests peculiar to them, are making constant demand on the soil for the particular food necessary for their growth and if they fail for any of the above reasons he knows of no other crops to fall back upon. In spite of this he manages to make both ends meet for the very simple reason that there is more land waiting for labour, unlike the case elsewhere. He can afford to leave his land fallow for a number of years to enable it to recoup its fertility. But this may no longer be possible, on account of more demand on land as a result of growing irrigational facilities and subsequent immigration of non-Sindhis from the congested parts of neighbouring provinces. And when this comes about the situation will get worse, as he is not familiar with the principle of intersive cultivation with suitable rotation of crops as is practised in other advanced countries.

What attempt the Agricultural Department has made to achieve this end is briefly described in this report elsewhere.

Organisation of the Department.—There are now four experimental farms at Mirpurkhás, Sukkur, Lárkána and Lándhi and one "Kalar" Reclamation Station at Daulatpur. Each is representative of the district in which it is situated and is devoted to its own line of work, according to the suitability of irrigational as well as climatic conditions and the marketing facilities obtaining in the tract. A separate detailed report dealing with the several experiments conducted on each of the first two farms is issued separately.

Mirpurkhás.—Is the headquarters of the department in Sind. Chief lines of work on this farm are related to cottons and rotation of crops. It is also a centre for distribution of seeds and implements.

Sukkur.—Farm is already fulfilling its object of successfully demonstrating the suitability of certain introduced crops and implements for Sukkur and Upper Sind Frontier District. As a result of the successful demonstration of the highly economic use of a pumping installation, two neighbouring zemindárs have already installed plants and a third has recently ordered out one for the purpose.

Lárkána and Lándhi.—Farms were sanctioned and the work started during the year under report.

Lárkána Station is devoted principally to the solution of problems connected with rice and "bosi" crops. Trials of cottons and various other crops with perennial well irrigation are also included in the scheme.

Landhi Farm has been selected for experiments on potato growing and garden cultivation. Nothing definite as regards experiments was done on these farms during the year. The chief operations were confined to erection of buildings, laying out of plots, ploughing and levelling for getting the land in working order. A beginning was, however, made by putting a small area under rice, wheat and fodder crops at Lárkána, and a few acres with berseem and potatoes on the Lándhi Farm; but the work was of a preliminary nature and therefore not worth mentioning in special reports.

Regular experiments have begun from the commencement of the present year and will be duly reported upon next year.

Daulatpur Reclamation Station.—This station has been successfully reclaimed and a completion report thereof already submitted. 150 acres of cotton were grown in kharif and 100 acres of berseem in rabi. The latter yielded good results and the green fodder was as usual in great demand by cattle owners. This station will be retained a year more and then probably disposed off.

Seed Farm.—A proposal is on foot to establish a Seed Farm for growing berseem, American cotton and other importantrseeds for distribution purposes. These crops have been introduced by the Department and ae hitherto grown mostly from costly imported seeds. An area measuring 200 acres has been selected near Mirpurkhás for this purpose; and as soon as the land has been finally acquired, the necessary operations will be taken in hand. These seeds economically produced here will considerably help in the extension of their cultivation.

Sub-Stations.—A net work of sub-stations has been set up with a view to demonstrate successful results already obtained on the central farms and thus bring home to cultivators the advantage of good cultivation and best methods of farming.

These sub-stations consist of 6 to 10 one-acre plots and are either taken on loan or rent from zemindárs. They are worked according to local practice by 'baries'. Each group of sub-stations is in charge of a graduate fieldman who has his headquarters fixed in a central place of his beat, where he maintains an office and a seed store as well. During the slack season he tours round the district and holds village to village demonstrations with improved implements and exhibits seed and crop samples. The whole system has been carried out with very encouraging results and is probably the best in reaching and influencing the cultivator.

The following were the sub-stations :—

1.	Jacobabad	...	...	...	Upper Sind Frontier.
2.	Shikárpur	...	...	...	
3.	Ubauro	...	...	...	Sukkur District.
4.	Nawábshah	...	...	...	Nawábshah District.
5.	Naushahro Feroz	...	...	...	
6.	Tando Md. Khan	...	...	...	
7.	Mátli	...	...	...	Hyderabad District.
8	Bádin	...	...	...	

Upper Sind.—Owing to short and unsatisfactory inundation the sub-stations suffered heavily in common with private fields. Ubauro was abandoned on account of absence of water up to the middle of July.

Shikárpur produced 3 maunds of American cotton and 2½ maunds Bhitshah cotton per acre each. A few pulses and cereal crops were also grown. In cold weather about a couple of acres were sown with wheat, also potatoes and berseem with well irrigation water.

Wheat yielded 10 maunds of grain and berseem was fed off to cattle.

The Jacobabad Sub-station practically failed on account of failure of the Begari Canal.

Nawábshah.—Two sub-stations, Nawábshah and Naushahro Feroz, were worked during the year and both of them did fairly well. At Nawábshah an acre plot produced 6 maunds of Bhitshah and 5 maunds of American cotton each. Upper Sind jowárs did better than the local ones and yielded 10 maunds grain per acre. Val, Tur, and other pulses did well.

Hyderabad.—Out of the three sub-stations, *viz.*, Tando Md. Khan, Mátli and Bádin, the last was abandoned for want of suitable land and other difficulties.

The other two continued to give good results.

Cottons.

Egyptian Cotton.—Trials of Egyptian cotton varieties Ábassi and Mit-Afifi have been continued on the Mirpurkhás Farm. A new variety Assil was also tried but with indefinite results so far.

This cotton was cultivated on an extensive scale by zemindárs in 1905 and 1906 when they were given lands on the Jamrao Canal on the understanding that they had to sow a certain proportion of their holding with Egyptian cotton. During the last few years the supply of water in the Jamrao Canal not being suitable the cultivators had been unable to sow this cotton with its long growing period and were therefore released from their original agreement. It is, however, possible to renew its cultivation when better irrigation facilities are available.

American Cotton.—Fairly large trials have been made with very good results with Upland American cottons on the experimental Farms and sub-stations as well as on cultivators' fields, and thus the possibility of growing successfully this cotton has been conclusively proved. It has the advantage of a short growing period wherefore it can be successfully grown even on inundation canals which during the rise of the Indus river receive water only for about 3½ months.

Of the varieties under trial Triumph has given the best results. An acre plot on the Mirpurkhás Farm has produced as much as maunds 13-3-0 = 1,100 lbs. of seed cotton. The following is the valuation of cotton grown on the Mirpurkhás Farm sent for valuation to Liverpool through Messrs. Ralli Brothers & Co.:—

"Dear Sirs,

Sindh American Cotton from Mirpurkhás. Your letter to us 8th February.

In accordance with your above letter we sampled the 7 bales in question of the Deputy Director of Agriculture in Sind and had them valued by Messrs. Stead Brothers whose prices Messrs. Coats have agreed to pay. We are invoicing them accordingly and will remit you the proceeds for account of Mr. Henderson at Mirpurkhás.

The reports on the three varieties are as follows :—

1. *B/S. A.* (Stapled American) value about 7d. 7/16 per lb. Class : about Fully Middling owing to cleanliness, but colour much duller compared to American ; Staple Full 1½ inch.

2. *B/S T. B. B.*—(Texas Big Boll) value about 6d. 13/16 per lb. Class: about Strict Middling owing to cleanliness but colour very much duller as compared to American. Staple hardly up to common Texas staple.

3. *B/S M. U.*—(Mixed Upland) value about 6d. 11/16 per lb. Class: about the same as the foregoing lot. Staple no better than ordinary American Upland Cotton.

All the above prices are on the basis of the usual Liverpool terms and were taken on the 29th March, when spot values for genuine Upland American Cotton were 7·10/100 for Fully Middling and 6·98/100 for Middling (with futures of the maturing month at 6·71/100).

The above prices are undoubtedly very encouraging, but being for sample lots and trial purposes they must not be looked upon as a safe criterion until quantities that would be of real practical interest to spinners are offered and some seasons' experience has shown that they can rely on the quality of the crop both as regards class and staple, especially the latter, which is the main factor of its value.

We are, etc
per pro Ralli Brothers,
(Signed) P. G. CALVOCORESSI".

Large indents for seed were received from zemindárs of Upper Sind and the Jamrao tract during the course of the year and were supplied from the 40 tons ordered out from America. To obviate the difficulty of getting the proper market value for the long stapled cotton which was experienced in the past and which to a certain measure retarded the extension of its cultivation, a Syndicate composed of the members of the Bombay Millowners Association, has been formed who have undertaken to set up ginning factories at Shikárpur and Mirpurkhás and to buy up the produce. The prices to be paid to the growers will depend upon the basis of the grading of sample to be sent to Liverpool.

The sowing and after growth are being supervised by Officers of the Agricultural Department. Further particulars with regard to its growth, yield etc., will form the subject-matter of the report for the year 1913-14.

Sindhi Cotton.—Owing to better cultivation and seed selection Sindhi cotton grown round about Hála is superior in staple and ginning percentage to that grown elsewhere. This seed is being used on all Farms and distributed among zemindárs as well. Its cultivation is steadily spreading to the north as well as the east of the province. Messrs. Ralli Borthers at Mirpurkhás are doing good work in supplying the seed extensively for sowing in the Jamrao tract. On the Mirpurkhás Farm an experiment is being carried out to see how far this cotton responds to better method of cultivation. The usual practice is to broadcast the seed, give one or two hoeings, and the usual waterings. According to the new method it is planted on ridges 1½ to 2 feet apart and hoed 3 or 4 times. This method apart from facilitating hoeing and weeding operations provides more space for the plant to develope and tiller. The success of the experiment has been striking, in that an acre plot yielded 1,710 lbs. of 'phuties', a record yield never obtained except perhaps on a very good virgin soil.

Hot Weather Cereals.

Jowárs under trial were Chapti, Perio and Sholápuri from the Presidency; red and white from Upper Sind and one from Lower Sind. The Presidency jowárs are distinctly superior to the local ones in grain, but do not seem to be suitable for cultivation on inundation canals, as they take much longer time to mature.

Upper Sind jowárs which are superior both in yield and grain to those of Lower Sind are being eagerly taken up by cultivators of the lower tract.

Wheat.

A number of South African, Australian and Indian wheats are under trial on various Farms. The chief feature of Sind wheat field is a hopeless mixture of red, white and bearded varieties with a certain percentage of barley which naturally reduces the price. Even in advanced tracts no attempt has been made to grow pure varieties. There has therefore been of late a considerable demand for pure seed of suitable varieties which are being supplied every year from Mirpurkhás and Sukkur Farm produce.

The selected seed besides being pure is superior in grade to the local one and consequently worth about 5 per cent more. The demand for the selected pure seed is more than the supply and is likely to be met with fully when the proposed seed Farm is started.

Among the manurial, cultural and varietal experiments on the permanent wheat plots, the efficacy of manuring in increasing the yield per unit is proved, as also the effect of hot weather ploughing on fallow land cropped in rabi.

Sindhi soft white wheat stands top most and has yielded 18 maunds per acre on the Sukkur Farm. A new variety of wheat known as Booji Mauro from the hilly tract of Kalat border was grown on the Lárkána Farm, one acre of Bosi crop yielded 660 lbs. It is hard, red wheat with thick grain and high gluten contents and is favourably reported upon by Messrs. Ralli Brothers in their valuation report given below :—

"We have examined the samples in question and find them both of good quality.

We especially like the Booji Mauro wheat which we find of exceptionally good quality. We think that such wheat would probably fetch about 8 annas per candy more than the ordinary quality of soft white wheat.

As regards the second sample of soft white, our opinion is that the quality of this wheat is also good, but that it would probably fetch only 4 annas more per candy than the ordinary quality of soft white wheat."

Fodder Crops.

It is popularly supposed that there is no practical advantage in growing fodder crops for the country cattle who could live on the natural grass on waste land supplemented by the ordinary grain straw.

The condition of cattle is admittedly miserable but they are said to be hardy enough for the purpose. It may be true that they are good enough for the present standard of cultivation but they will never do for improved methods of culture; unless proper attention is paid to their feeding and a regular system of breeding followed.

Cotton has been steadily displacing the food-grain crops owing to its rising price of late. This is extremely deplorable from the stand point of fodder specially when there are no special crops grown for this purpose. The adequate supply of fodder thus grows to be a more and more serious problem.

The matter grows worse particularly in the cold weather when the natural grass is scarce. The situation can, however, be remedied as experimental trials have proved the value of certain jowárs yielding 3 to 4 cuttings of fodder if sown in good time.

Besides Egyptian Clover (Berseem) does very well under irrigation in cold weather and in addition to giving 3 to 4 cuttings of nutritious fodder, yields from 1 to 2 maunds of seed per acre if left for the purpose. It further makes an excellent hay. Its cultivation is mostly confined to Government Farms at present where it is in great demand by cultivators for feeding their animals. Its value both as a fodder and renovator of soil is recognised in certain tracts and even outside the province. Small indents fairly large in number are received every year. The seed when imported costs Rs. 16 per maund of 80 lbs., but it may be possible to produce cheap seed on the proposed seed Farm.

Val, a good growing pulse, gives a succession of cuttings for the most part of the year and also Choula provides a good fodder in kharif. The pulse fodders are relishingly taken by cattle and are far more nutritious than those of the ordinary cereal crops.

Miscellaneous.

The common oil seeds, fibre crops and pulses were cultivated for comparative tests. Among pulses, Tur and Val are most valuable introductions. A Poona variety of sugarcane, *viz.* Pundhia, is also grown and is in demand by cultivators for planting on account of its softer and sweeter canes.

Among the new trials were Australian fodder grasses, Soy beans, Velvet beans and Chinese Oats.

Fungoid and Insect Pests.

Mahlo or mango hopper did some damage to mango crop but wheat and jowárs were practically immune from rust and smut. Potato moth continues to damage stored potato seed round about Karáchi. Measures are being adopted to find out better method of storing the seed.

There was practically no boll worm in cotton during the year under report.

Garden and Fruit Culture.

Some five varieties of grapes introduced by the Department have continued to grow well and are very much appreciated by the public. Local prices obtained are, however, poor in a

small town like Mirpurkhás. Other superior fruit trees obtained from Saharanpur and Poona are doing well. There is a fairly large demand for the seedlings of these as well as for the cuttings of grape vines. They were distributed as far as the supply admitted.

Agricultural School.

During the year under report a Vernacular Agricultural school was opened at Mirpurkhás. The object of the school is to give training in practical agriculture to zemindárs' and cultivators' sons. The course is a twelve months' one with two sessions. Instructions are given in the vernacular by the Head Master who is a graduate of the Agricultural College, Poona. The following are the subjects taught :—

Theoretical.	*Practical.*
1. Agriculture.	Practical Agriculture.
2. Entomology.	Do. Entomology.
3. Veterinary Science.	Do. Veterinary.
4. Land Survey and Mensuration.	Field Survey and building measurements.
5. Botany Elementary.	.....

The greater part of the time is spent in field work where the boys are familiarised with Farm operations, handling of implements, etc.

There are only 8 students at present. They receive a food allowance when required of Rs. 10 per mensem each and are required to live on the Farm in the students' quarters constructed for the purpose.

The institution is getting popular as numbers of applications are received for admission into the school. It will therefore be possible to start the 2nd year with 10 or even a dozen boys.

Poultry.

A white strain of Persian Gulf fowls for eggs has been bred and is kept on all farms. They lay well. Upper Sind game are bred for table. A fair number of Turkeys have also been raised. Some Mamoth Bronze Turkeys were obtained from Pusa last season for breeding purposes. Both eggs and chicks are in great demand by land-holders as well as other private persons.

Seeds and Implements.

During the year a considerable amount of seeds of various kinds was distributed both from the farms and the sub-stations and in some cases direct from growers.

Implements are being made on a small scale at Mirpurkhás and Sukkur. These are ploughs, levellers, "Norags" or Threshing machines and archimedian screws and ridging boards.

The following is the list of seeds and implements distributed through the Department :—

American cotton 40 tons.

Berseem 4,387 lbs.

Italian potatoes 4 tons.

Wheats and others 6,000 lbs.

Ploughs 400.

Few Hand Archimedian Screws and Scrapers.

There is probably no other implement so successfully popularised as our improved wooden plough. In sowing seasons large numbers of these are seen carted by cultivators from the private workshops and Government Farms.

I have no hesitation to assert that in certain tracts of Lower Sind the country ploughs have almost entirely disappeared and been replaced by the improved ones.

This is sure to bring about a marvellous change in the existing poor state of cultivation.

In view of the increased demand for this implement and also owing to the fact that Government Agency could no longer act as a dealer, a firm at Hyderabad was induced to take up the concern. This firm has been making a good business out of it and is supplying ploughs direct as well as through the Department.

During the course of the year two more firms in Mirpurkhás have spontaneously taken up the industry, not only for the ploughs, but for other popular implements too, as noted above.

The concern is advertised freely in certain local papers. The total number of ploughs sold throughout Sind during the year was close upon a thousand. This gives a practical testimony of the high popularity of the implement.

Archimedian screw proved very successful for short lift; and for lifts up to 12 feet a Noria lift has been found to be efficient.

On the Sukkur Farm a centrifugal pump driven by steam engine has been working cheaply and efficiently.

Leaflets and Bulletins.

The following of these were printed and distributed broadcast:—

Cropping schemes of Mirpurkhás, Lárkána, and Ládhi Farms. Leaflets on Boll worm on cotton, fodder crops in Sind and revised instructions for the cultivation of American cotton both in English and Sindhi.

Demonstrations and Shows.

Village to village demonstrations were held by the itinerant graduate fieldmen in all parts of Sind, in all 76 demonstrations came off.

The departmental exhibits combined with classes for zemindári produce were held at Sukkur, Mirpurkhás, Naushahro Feroz and Tatta. Badin show was given up owing to shortage of water-supply. These shows justify their existence by the amount of interest they create among the hundreds and thousands of attending zemindárs and Haries.

GUL MUHAMMAD,
Acting Deputy Director of Agriculture.

APPENDIX F.

SUMMARY OF WORK DONE UNDER THE PROFESSOR OF AGRICULTURE, BOMBAY PRESIDENCY, 1912-13.

Sugarcane.

I.—Rotation Experiments.

These have in the year under report still further emphasized the value of san as a green manure to replace the usual dressing of farm yard manure. When the application of farm yard manure given to the green manured plot was reduced to only ⅓rd the usual quantity the yield of gul per acre was over a ton greater than when the full quantity of manure was given and a fodder crop was taken. The green-manuring costs Rs. 16 whereas the extra farm yard manure costs Rs. 48. The increased gul is worth Rs. 184 or a net gain of Rs. 232 but from this we must deduct the net profits of the fodder raised of Rs. 97 which give Rs. 135 as the greater profits of this system over growing fodder. The fodder growing also increases the danger of borers to the young cane. The advantages of green manuring over the taking of a crop previous to planting cane at each rotation seems to be accumulative as the gain from the green manured plots of the series over the others is increasing every year.

Fallowing has increased the outturns by 2,000 lbs., worth Rs. 155 and at a cost of only Rs. 2 per acre. If the net profits from the fodder are deducted we get Rs. 65 as the gain of fallowing over growing of a fodder crop.

II.—Manuring.

(*a*) *Mineral manures as a source of nitrogen.*—Ammonium sulphate has again given exceptionally good results; compared with safflower cake the yield is fully 40 per cent. higher. With the prices prevailing last year the net profits are increased by Rs. 180.

Crude Nitre gives a higher yield than safflower cake but its cost is prohibitive.

(*b*) *Time of applying top dressing.*—The results emphasize the value of top dressing but no increase in value is obtained from applying it at two times.

(*c*) *Trial of potash and phosphoric manures.*—The results with these manures were vitiated by borers.

(*d*) *Trash or dried sugarcane leaves (pachat).*—This is as valuable as farm yard manure and is more lasting in its effects as is shown by the fine condition of the ratoon from this plot. The new furnace saves from one acre nearly enough of this manure to suffice for manuring that area.

III.—Work to ascertain the factors that affect the quality of gul.

The experiments of the year lead us to believe that if the cane is of the same variety and thoroughly ripe the part played by manures or soil upon colour, hardness, crystallization or taste are of very much less importance than the operations connected with gul preparation like clarification, speed of boiling, striking temperature or removal from the fire, and method of cooling.

Those manures which are said to produce poor gul often cause this effect through prolonging the growing period so that unless the juice is carefully tested the cane will be harvested too early.

IV.—Kinds of sets.

The terminal sets of each cane are the best for planting while they are the poorest in sugar content. Sets from ratoons are inferior to those from plant cane. Considerable increase is possible by assorting the sets carefully and rejecting the poor ones.

V.—Crushing.

The Pearl Mill has been carefully tested and found to be sufficiently superior to the Poona Mill in points of extraction, capacity, and labour required for operation to more than make up for its costing double.

The Nahan Mill is in no way superior to the Poona Mill.

VI.—Furnaces.

The new furnace continues to show great superiority over the Poona furnace in saving of fuel, labour and time.

VII.—Cultivation.

One thorough ploughing by the Eagle Gallows and the reduction of the soil by discing and cultivating reduce the cost of preparation by fully one-half over that of using country plough and harrow.

Planting in rows so that hand weeding and hand earthing can be dispensed with still further cuts down the cost of cultivation.

Groundnut.

The work with this crop is included under spacing, varietal and manuring.

1. *Spacing.*—This was continued with Spanish peanut only the distances were 9 × 6 and 6 × 4. In a year like last, where the rainfall was deficient, the heavier seed rate has not shown its usual superiority in all cases.

2. *Varietal.*—Pondichery was ahead of the larger varieties in all trials, Mauritious a similar type of nut has also done well. The small varieties have kept the yield up better under poor rainfall than the large ones. Egyptian, a new type containing 3 seeds per pod like the country variety, but with large kernels like the big varieties has given the biggest yield.

A new variety, combining the erect habit and compact growth and nut cluster permitting easy harvest, but with the large sized kernel of Big Japan has been found and in the past year gave good results.

3. *Manure.*—Lime used with other manures has given the best results. Potash alone has also increased the yield.

Bájri.

Akola bájri continues to give good results. Pure strains of awned bájri have not yet been isolated.

Jowár.

Variety tests on College Farm with six varieties show Gidgap as the biggest yielder of grain and fodder.

The quality of the grain is excellent but the fodder is coarser than that from Nilwa and Utavli.

Gudgi is early and of good quality.

Manure tests for this crop show advantage from lime and potash dressings.

Rice.

Only pot experiments were carried on and the results will be included with those of next year in a separate publication. The results take up one step further in the investigation.

Wheat.

On College Farm san for green manure has proved a more profitable preparatory treatment than farm yard manure. At Mánjri the green manuring has doubled the crop but the factor of time of sowing had some influence.

Nitrate of soda has increased the outturn but not profitably at present prices.

Rust was very severe at Mánjri especially in the late sown plots.

The Australian varieties have done best producing nearly 2,000 lbs. as dry crops. On account of their earliness they largely escape rust and can be recommended for locations where rust is prevalent.

Gram.

The yellow seeded variety proves itself superior to the black seeded.

Lucerne.

The manure experiments continue to show a profit from the use of the mineral manures, sulphate of potash and superphosphate. The quantity of farm yard manure can be lessened each year, if its application is continuous, since the humus content of the soil reaches its best proportion and requires only a light application to maintain it.

Cotton.

Manure experiments have shown cotton to be the most benefited by farm yard manure (10 loads per acre). Of the chemicals, potash has shown the greatest benefit and lime has also improved the yield.

The quality according to Tata Bros. valuation is noticeably improved by manuring of the cotton.

Varieties.

Buri and Cambodia have not done well. Broach in Poona produces an average outturn of over 800 lbs. without irrigation and when pure Navsári seed is used the product is equivalent to Fine Surat.

Each of the four Khándesh types have been grown separately one of those known as Cutchica a white flowerd broad leafed cotton has produced nearly 1,500 lbs. of seed cotton with a ginning percentage of over 39 per cent. The quality is nearly equal to the original mixture.

Our roseum and malvensis give better outturns than that from the seed of the same varieties obtained from Berar.

The gross money return from the first type mentioned (Cutchica) comes to Rs. 117-9-3 per acre as compared to that of the mixture of only Rs. 78-8-0.

The cultivation of roseum and this type round about Poona offers promising opportunities for paying crops.

The most marked results obtained during the year are from experiments in separating the seed cotton by the method adapted by G. D. Mehta, M.Sc., from the American publications. Three varieties—Broach, Dhárwár-American and Khándesh—were experimented upon and improvement in germination, vigour of growth cutturn per plant, ginning percentage and quality was obtained amounting in all from 33 per cent. to 80 per cent.

The poor quality of the seed obtained led us to test the farm seed and the poor results thereby obtained emphasize the necessity of investigating the factors affecting the quality of the seed sown. Our results show that the ginning of the kapas is not entirely to blame for the poor seed.

Tobacco.

Sulphate of ammonia has doubled the outturn of tobacco.

Potatoes.

The yield has been increased by sulphate of potash sufficient to make its use profitable. The ridge system has increased the outturn by 50 per cent.

Thicker sowing ($1\frac{1}{2}' \times 1'$) gives better results than thinner ($2' \times 1\frac{1}{2}'$).

Onions.

Ridge system gives $16\frac{2}{3}$ per cent. greater yield. The bulbs are larger but are not valued as highly.

Nitrate of soda has proved itself better adopted to this crop than sulphate of ammonia but owing to the higher price it is not so profitable.

Turmeric.

This crop did exceptionally well this year on Mánjri Farm and has given a net profit Rs. 439 per acre.

VIII.—Fodder.

The study of a number of fodders on College Farm with regard to their quality season of growth, etc., puts maize in the front rank as producing more fodder in quantity and better in quality than any species of sorghum or jowár. Some of the smaller millets like Dhengli are richer than maize but less in outturn.

IX.—Implements.

The ploughs and harrows mentioned last year have also given good results this year. The clipper drill price Rs. 55 seems to be adapted to Indian conditions better than any drill tried. Some attention to yoking and hitching has resulted in the production of a better yoke and better use of chains which economize time and energy.

Distribution.

The College Farm serves as distribution depôt for the Central Division.

The Mánjri Farm serves the same function with regard to sugarcane sets, crushers, gural furnishings and sending out of trained workers.

Education.

This is the main work of the Professor of Agriculture and his staff. Besides the regular B.Ag. courses the short course men and special schools in dairying and sugarcane work were held.

J. B. KNIGHT,
Professor of Agriculture.

APPENDIX G.

SUMMARY OF WORK DONE UNDER THE EXTRA DEPUTY DIRECTOR OF AGRICULTURE IN THE KONKAN, 1912-13.

The season 1912-1913 was on the whole good.

Rice.

2. The most important crop cultivated in the Konkan is rice.

So far as the situation and level of rice lands is considered, they may be grouped under three classes. There are low-lying lands called "Mala" lands and also high-lying of uryat" or "Makki" lands. The lands situated between "Mala" and "Kuryat" lands may be termed "Intermediate" lands.

Green-manuring by sowing seed in the beginning of the monsoon.

3. The monsoon in the Konkan ordinarily commences at the end of May or early in June. Seed is sown at that time on seed-beds and seedlings grow on them till the first week of July, when their transplanting begins. With the object of testing the idea of growing a green-manuring crop on rice fields by sowing san at the end of May and ploughing down the crop in July a few days previous to transplanting them with rice seedlings, experiments have been carried out at the Alibág Farm and in the districts and the results show that a green-manuring crop cannot be grown in June on low-lying or "Mala" lands. As lands of this description are flooded with rain-water in June, plants of san perish. As a rule, however, "Mala" lands do not require manuring so much as high-lying and intermediate lands do.

When high-lying and intermediate rice lands have been green-manured by the method described above, good results have been obtained. Green manuring is a cheap method of manuring rice lands and the prospects of its introduction in the Konkan for maintaining and improving the fertility of high-lying and intermediate rice lands are hopeful.

At Honávar, Maldoli, Umbargaon and Kelva-Máhim, san was sown early in June on high-lying and intermediate rice lands and the green crop was ploughed down in July, previous to transplanting the fields with rice seedlings. The increase in the outturn of paddy due to green-manuring varied from 23·5 to 60 per cent.

The green-manuring experiments carried out at the Alibág Farm by sowing san on rice land in the beginning of June did not give satisfactory results, as the heavy texture of the soil and water-logging were adverse to the growth of san plants. Dhaincha was also tried side by side with san. The former is very slow in growth in the first few weeks after germination and is not suited for green-manuring rice lands by sowing it as the end of May and ploughing it down in July.

Other methods of green-manuring rice lands.

4. Experiments have been started for testing the method of sowing san and dhaincha seeds in standing rice crop a few days previous to its harvesting and ploughing down the green crops when in flower. Another method of green-manuring which is under investigation is to sow san and dhaincha seeds in ploughed fields after the harvesting of rice and plough down the green crops when in flower. The results of these methods of green-manuring as shown in the outturns of paddy will be available for the next report.

Application of bulky manures.

5. Mohra refuse is available in large quantities at Uran and it is now thrown into the sea. Rice hulls also are not properly utilised for manure in certain parts of the Konkan. Cultivators do not take pains to conserve cattle-urine by spreading on the floor of cattle sheds some kind of litter or earth. An attempt was therefore made to prepare "Urine-earth" on the Alibág Farm by spreading dry earth on the floor of the cattle-shed for absorbing urine. The urine-earth so prepared and kept stored and also rice hulls and mohra refuse were applied to rice fields at the rate of 5 tons per acre and ploughed down early in June. The fields were transplanted in July and the results show that the application of mohra refuse has increased the outturn of paddy by 800 lbs. of grain per acre valued at Rs. 22. The cost of transporting mohra refuse from Uran to the farm has been excessive. It can, however, be considerably reduced, if cultivators living near the Uran distilleries carry the manure in boats and apply it to their rice lands.

Concentrated manures.

6. Castor, groundnut and karanj cakes were applied to transplanted paddy at the Alibág Farm at the time of puddling, at the rate of 30 lbs. of nitrogen per acre. Castor-cake has given good results, giving an increase in grain of 650 lbs. per acre. But the excessive cost

of the manure which had to be brought from Surat has reduced the net profits per acre. This of course suggests the necessity of growing castor as a rabi crop in rice fields in order to make castor-cake available in the Konkan and of experimenting by applying smaller quantities of nitrogen per acre.

7. Fish manure which is available in the Konkan was applied at the Alibág Farm to transplanted paddy at the time of puddling at the rate of 30 lbs. of nitrogen per acre. In the case of comparatively poor land, the application of the manure increased the net profits by Rs. 12 per acre.

Artificial manures, etc.

8. Basic slag, ammonium sulphate, nitre and bone meal were applied to transplanted paddy at the Alibág Farm. Basic slag was applied alone or in conjunction with ammonium sulphate or with green manuring with san sown in June and ploughed down in July. Nitre was applied with or without bone meal. The results show that the applications of these manures have almost invariably reduced net profits. It is proposed to experiment in the ensuing season with applications of smaller quantities of these manures per acre.

Transplanting.

9. The present practice in the Konkan is to transplant about 16 seedlings in each hole. With the object of ascertaining whether a reduction in the area of seed-bed required for raising seedlings sufficient for transplanting an acre is possible, two series of experiments were carried out. In the first series, seed was sown on seed-bed as thickly as in the local practice, *i.e.*, 12 lbs. per guntha of seed-bed and seedlings raised were transplanted in bunches of 1, 4, 8 and 16 at usual distances. In the second series, specially strong seedlings were raised by sowing seed thinly on seed-bed, *i. e.*, at the rate of 4 lbs. per guntha of seed-bed. These seedlings were transplanted in bunches of 1, 2, 4 and 8 at ordinary distances. The results show that the method of transplanting 4 seedlings in each hole is the best. They also suggest that by raising specially strong seedlings by sowing seed thinly and transplanting a few seedlings in each hole it is not only possible to effect a great saving in seed but also to increase the outturn of paddy. The total area under transplanted paddy is about 7 lákhs of acres. The saving in seed alone valued at Rs. 1-8 per acre which could be effected by adopting the new method of transplanting would annually add to the agricultural wealth of the Division by more than 10 lákhs of rupees.

Ploughing rice fields in the fair season.

10. It is the practice in the Konkan to leave rice fields unploughed till the beginning of the monsoon. The popular belief is that ploughing in the fair season is not beneficial to the rice crop. In order to test the soundness of this belief, two plots were taken, of which one was ploughed in the rabi season and the other kept unploughed. After the commencement of the monsoon, both the plots were ploughed and transplanted with paddy. The increase in the outturn of paddy due to ploughing in the fair season was 208 lbs. per acre.

The Japanese method of selecting paddy seed in a solution of common salt.

11. In Japan, it is the practice to select paddy by using a solution of common salt and water prepared by mixing them in the ratio of 1 to 2. When paddy seed is immersed in it, heavier grains sink to the bottom and lighter ones float. The latter are removed and used for eating or other purposes and the former are taken out, washed in water, dried and then sown. An experiment to test this method of selecting paddy seed was carried out and selected seed was sown on seed-bed. Seedlings raised from the selected seed and also those from ordinary non-selected seed were transplanted on comparative plots. The increase in the outturn of paddy by 136 lbs. per acre shows the superiority of seedlings raised from seed selected by the "Salt-water" method.

Groundnut.

12. Two varieties of groundnut—Small Japan and Spanish peanut—were tried at the Alibág Farm. The former variety gave an outturn of 1,230 lbs. of nuts per acre and the latter 870 lbs. In the case of these two varieties, the net profits per acre were Rs. 52 and 24, respectively.

Cotton.

13. The Bourbon cotton plot at the Alibág Farm was maintained in the year under report. It gave an outturn of 370 lbs. of seed cotton per acre valued at Rs. 46-4. Buri cotton also was tried. But it failed altogether.

Jowár.

14. Belgaum and Sundhia jowárs were tried on warkas land in the kharif season. The former gave an outturn valued at Rs. 41 per acre, whereas its cost of cultivation per acre was Rs. 20-7-6. The cultivation of Sundhia jowár resulted in a loss. *Imphee sorghum* was tried on a small scale and grew well. Belgaum jowár and *Imphee sorghum* will be cultivated in the future at the Alibág Farm.

Dibbling wal in the standing rice crop.

15. In certain parts of the Konkan, gram and wal are cultivated as rabi crops in low-lying rice fields, which hold sufficient moisture for maturing them. The rice area of the Alibág Farm, though it gets sticky and water-logged early at the commencement of the monsoon, loses its moisture rapidly and is not well-suited to the cultivation of rabi crops. It was, however, thought that rabi crops could be grown even on lands similar to the rice area of the Alibág Farm by dibbling their seeds in the standing rice crop and starting them on their growth before the harvesting of rice. Wal was dibbled according to this method and also broadcasted in the standing rice crop. The results obtained are very good. Wal dibbled in the standing rice crop yielded an outturn valued at Rs. 35-10 per acre giving a net profit of Rs. 15-13-4 and the same broadcast in the standing rice crop yielded an outturn valued at Rs. 25-11-8 per acre, giving a net profit of Rs. 13-4-1.

Interculturing of Wal.

16. In the Konkan, wal is not intercultured. An experiment was carried out at the Alibág Farm with the object of investigating whether interculturing would benefit the wal crop. The results are not satisfactory. The heavy rains of November benefited both the treated and untreated plots which perhaps did not therefore need interculturing and conserving soil-moisture.

Wal and castor.

17. In Gujarát castor and wal are grown as mixed rabi crops in rice fields. But this practice does not obtain in the Konkan. An experiment was therefore conducted at the Alibág Farm and castor and wal were sown according to the Gujarát method. The experiment did not prove successful and in the ensuing season castor and wal will be dibbled in the standing rice crop.

Irrigated crops.

18. In the neighbourhood of the Alibág Farm, brinjals, water-melons and onions are grown as irrigated crops in rice fields in the hot season. Potato is not one of the irrigated crops cultivated in the locality. With the object of ascertaining what manures were best suited and what crop was the most paying, water-melon, potato, onion and brinjal were cultivated and karanj cake and fish manure were applied as manures. The results show that onion is the most paying crop and that by using fish manure for this crop a net profit of Rs. 114 per acre could be made.

19. In Bassein and Máhim tálukas, large quantities of castor-cake to the aggregate value of several lákhs of rupees are annually used for manuring garden crops. The price of castor-cake which on an average contains 4 per cent. of nitrogen works out at Re. 0-14-0 per pound of nitrogen; but the price of nitrogen per pound in ammonium sulphate comes to annas 9 and pies 6. With the object of ascertaining whether any economy could be effected in the cost of manure, an experiment was carried out at Kelva-Máhim. Two series of comparative plots of sugarcane, ginger, and plantain were taken and one series treated with the usual quantity of castor cake. The other series, however, was treated with half the usual quantity of castor-cake with ammonium sulphate equivalent in nitrogen to the other half. The plot of sugarcane treated with 45 lbs. of castor-cake and 9 lbs. of ammonium sulphate yielded better than the plot of sugarcane treated with 90 lbs. of castor-cake alone. The plot of ginger treated with 105 lbs. of castor-cake and 21 lbs. of ammonium sulphate and that of plantain treated with 40 lbs. of castor-cake and 8 lbs. of ammonium sulphate did better than the plots of ginger and plantain treated, respectively, with 210 and 80 lbs. of castor-cake. If the method of applying half the usual quantity of castor-cake in conjunction with ammonium sulphate equivalent in nitrogen to the other half is adopted, the cost of manuring the irrigated crops in the garden tract of the Thána District could be reduced by about 25 per cent.

20. Berseem was tried under irrigation as a fodder crop on the Alibág Farm. It grew well and yielded an outturn of nearly 16,000 lbs. of green fodder per acre valued at Rs. 125.

Bandh Crops.

21. The practice of growing crops on bandhs of rice fields largely obtains in the Alibág táluka. It is well known that after transplanted paddy has struck roots, the more water the rice fields hold the better it is for the crop. The capacity of rice fields to hold water depends upon the height, width and condition of their bandhs. In the South Konkan, the scramble for land is so great and the sub-division of fields has been carried on to such an extent that cultivators of rice fields always slice off their bandhs with the idea of adding to the area under cultivation. It is therefore desirable that in those localities where bandhs of rice fields are defective proper bandhs should be kept and that they should be planted with crops. With the object of ascertaining what crops were best suited for cultivation on bandhs, an experiment was carried out and the results show that tur, ghewada and *Imphee sorghum* grow well on bandhs of rice fields.

Ensilage.

22. In the Konkan grass begins to flower in September. Cultivatiors do not cut it at that time and allow it to seed. If grass is cut in September, hay-making is not possible owing to rainy weather. With the object of ascertaining whether ensilage can be cheaply made by cutting grass in September and pitting it on high ground an experiment was made on the Rasani mound near the Alibág Farm. As there was rain in November, the upper part of the ensilage was spoilt by the water that soaked into the pit. But the lower part was good ensilage and cattle ate it with relish. The experiment will be repeated and the silo-pit covered with a shed to prevent the soaking of water into it.

Poudrette.

23. Night-soil is largely used in China and Japan as a field manure for rice. In the Konkan it is not utilised for any crops. An attempt has therefore been made to prepare poudrette on the Alibág Farm and use it for rice.

New Implements.

24. The following implements were tested at the Alibág Farm :—

(1) The W. K. S. plough.

(2) The Norag Thresher.

(3) The Grass Mower.

The W. K. S. plough.

It was found by experience that the Meston plough which is very light was not quite suited to the clayey soils of the North Konkan. The W. K. S. plough manufactured by Ransome Sims and Jeffries was therefore obtained and tested. This plough works satisfactorily both in the kharif and rabi seasons, provided that the soil is not very sticky. The W. K. S. plough works 16 to 18 gunthas of land per day and does nearly 75 per cent. more work than the local wooden plough. This plough requires a good pair of animals and is sold for Rs. 18 at the Alibág Farm.

The Norag Thresher.

In Sind, the Norag Thresher is used for threshing wheat, rice, etc. A thresher of this kind was imported from Sind and tested on the Farm. For threshing paddy with it one pair of bullocks, one man and one woman were required. The cost of threshing half a khandi, *i. e.*, 720 lbs. of paddy with the Norag Thresher amounted to Rs. 1-6-10, whereas the cost of threshing paddy by the ordinary local method was Rs. 1-5-2 per half khandi. The one disadvantage of the Norag Thresher is that it breaks or removes the husk of some grains, while threshing. However, in those localities where human labour required for threshing paddy by the local method is scarce, the Norag may be recommended.

The Norag Thresher was obtained at the Farm at a cost of Rs. 69, including Rs. 19 paid as freight, etc.

The Grass Mower.

The grass mower which costs Rs. 193 in Bombay was tested at Tadwagla in the Alibág táluka and was found to cut five acres of grass per day. For cutting grass with this machine, one pair of buffaloes, two men—one to drive the buffaloes and the other to rake the cut grass—and three women to follow the mower and lift the grass were required. Twenty-six more women were also required for making bundles of the cut grass of five acres. The total cost of working the mower per day was as follows :—

	Rs.	a.	p.
2 men	0	8	0
2 buffaloes	0	8	0
3 women	0	9	0
26 women	4	14	0
Depreciation, repair and interest on the mower ...	1	0	0
Total Rs. ...	7	7	0

With this expenditure five acres were cut in a working day. The cost of cutting and bundling grass with the mower therefore comes to Rs. 1-7-10 per acre, whereas the local contract rate for cutting and bundling grass is Rs. 4 to 4-8-0 per acre. This means that if we calculated the work on the basis of local contract rate, the mower can do the work of Rs. 120

to 22-8-0 per day. For working the mower, the land should be cleared of stones and bushes. The expenditure incurred in making the land suitable will be more than met by the saving in the cost of cutting grass that can be effected by the use of the mower. The mower can be worked on fairly slopy as well as level land.

The Planet Junior Hand Hoe.

One two-wheeled Planet Junior Hand Hoe has been obtained from Poona at a cost of Rs. 14. The Hoe will be worked for weeding groundnut and the results will be available for the next report.

Denaturalised salt for manure.

25. The demand for common salt for manuring purposes has been very keen throughout the Konkan Districts. Cultivators want it for manuring cocoanut and mango trees. In Goa, salt is applied to rice lands as well as to cocoanut and mango trees. It has therefore been a problem with the Department in the Konkan to find out a cheap method of denaturalising salt, so that salt denaturalised and issued for agricultural purposes might not be utilised for other purposes.

In 1911-12 two hundred maunds of salt were denaturalised by using 5 per cent. cattle dung as denaturalising material and issued to cultivators. In the case of cocoanut, mango and rice, the application of denaturalised salt has increased the outturn. The method of denaturalising salt by using cow dung did not stand the test of the Chemical Analyser and was soon abandoned.

In the course of the year under report I brought to the notice of the Director of Agriculture a new process of denaturalising salt with bone dust and black liquid fuel oil and samples of salt denaturalised with those materials were submitted to the Agricultural Chemist for analysis. His report is as follows:—

"I.—Sample of salt denaturalised with 5 per cent. bone dust and 1 per cent. fuel oil:—This when dissolved in water and filtered gave yellow filtrate smelling badly of the putrified matter from the bone dust. On evaporation salt was removed but the offensive smell persisted and the salt had yellow colour. On strongly heating the salt it charred and gave out a very disagreeable smell showing presence of soluble organic matter in the bone dust.

"II.—Sample of salt denaturalised with five per cent. bone dust and two per cent. fuel oil:—This gave exactly the same result as above excepting that the yellow colour and the disagreeable smell were more pronounced.

"III.—Sample of salt denaturalised with one per cent. fuel oil:—This on dissolving and filtering gave clear filtrate without almost any smell; on evaporating the liquid, good white edible salt was obtained.

"IV.—Sample of salt denaturalised with two per cent. fuel oil:—This gave almost exactly the same result as sample No. 3.

"It seems from this that the efficient material for denaturalising salt is bone dust. Addition of fuel oil is of no use.

"I therefore would prefer the menthod of adding 5 per cent., bone dust and 1 per cent. fuel oil so as to render common salt effectually inedible".

The price of bone dust is Rs. 1-10 per Bengal maund at Karáchi. The prices quoted by the Thána Bone Mill are excessive. The price of ordinary kerosene oil is Rs. 1-12 for 4 gallons in bulk; but that of black liquid fuel oil is Re. 1 for the same quantity. The latter, on the other hand, is stronger in smell than the former and can be obtained from Messrs. Shaw Wallace and Company, Bombay. The weight of a gallon of black liquid fuel oil is about 9 lbs. The prices of materials required for denaturalising 100 Bengal maunds of salt are as follows:—

	Rs.	a.	p.
Price of 5 Bengal maunds of bone dust	8	2	0
Price of 1 Bengal maund of black liquid fuel oil ...	2	5	0
Total Rs. ...	10	7	0

The freight charges to be paid on small consignments of these denaturalising materials despatched to several ports in the Konkan amount to considerable sums and so we may add to the above sum Rs. 8-5 as freight charges. The total cost of materials required for denaturalising 100 Bengal maunds of salt may thus be taken at Rs. 18-12, which works out at the rate of 3 annas per maund of salt denaturalised. Ordinary salt is issued by the Government to fishermen at 7 annas per maund for fish-curing purposes. It is therefore reasonable that cultivators requiring salt for manurial purposes should pay 10 annas per Bengal maund of salt and provide the labour required for mixing it with the denaturalising materials which should be supplied by the Government.

Four hundred maunds of salt were denaturalished in the year under report by the new method described above and issued to cultivators for using the same as manure.

"Kumri" cultivation in Kánara.

26. In certain parts of the Kánara District, a very wasteful method of cultivating ragi, called "Kumri" cultivation is practised. Jungles are cut down in the fair season and burnt. Ragi seed is sown broadcast on the burnt ground in the beginning of the monsoon and the crop obtained is not in proportion to the jungle-growth destroyed. With the object of ascertaining whether the method of raising ragi seedlings on burnt or "rabbed" seed-bed and transplanting them on ploughed land could be introduced into Kánara, an experiment was carried out and the results are as follows:—

Treatment.	Superior land; outturn per acre.		Inferior land; outturn per acre.		Remarks.
	Grain.	Straw.	Grain.	Straw.	
	Lbs.	Lbs.	Lbs.	Lbs.	
Burning the ground and broadcasting seed over it ...	960	600	384	300	
Burning seed-bed only and transplanting seedlings on ploughed ground.	1,230	1,920	600	832	

In "Kumri" cultivation, the jungle of the whole area to be sown broadcast with ragi seed is cut down and burnt. But in "ráb" cultivation, only about 4 gunthas should be burnt with branches, dry leaves, etc., for raising ragi seedlings sufficient for transplanting an acre. The results obtained suggest that the introduction of the ráb system of ragi cultivation will lead to the conservancy of jungles in those tracts where "Kumri" cultivation is practised.

Tobacco.

27. In Ceylon and Java, tobacco is cultivated as a second crop on rice lands. In an experiment conducted in Kánara tobacco was cultivated in the rabi season on rice land. The outturn per acre was 840 lbs. of tobacco valued at Rs. 210. Further experiments will be made on this valuable crop.

Ratnágiri Farm.

28. An experimental station at Shirgaon near Ratnágiri has been started with the object of carrying out systematic experiments on rice, sugarcane and other local crops. This farm which was occupied in May 1913 is typical of the laterite tract of the Konkan, whereas, the Alibag farm represents the trap area of the Konkan. For starting experiments on groundnut, san, nagli and other warkas crops, a warkas plot of about 25 acres will be added to the area already taken for the Ratnágiri farm.

Distribution of seed, manure and implements.

29. The following quantities of san and groundnut seeds were distributed:—

District where distributed.	Quantity distributed.		Remarks.
	San.	Groundnut.	
	Lbs.	Lbs.	
Thána	4,540	3,166	
Kolába	1,660	2,404	
Ratnágiri	11,381	8,564	
Kánara	3,160	3,920	
Total ...	20,741	18,054	

Twelve thousand sets of Red Mauritius sugarcane were imported from Baindur (South Kánara) and dsitributed to cultivators in Kánara.

The following seeds were also distributed:—

Kind of seed.	Quantity in Lbs.	Remarks.
Banku paddy	752	
Rata paddy	594	
Tur (for bandh-cultivation) ...	294	
Ghevda (for bandh-cultivation) ...	252¾	
Imphee Sorghum	51	
Cocoanut seedlings	64	
Plantain suckers	60	
Pine apple suckers	40	

30. The following quantities of manures were distributed:—

Kind of manure.	Quantity in Lbs.	Remarks.
Ammonium Sulphate	910	
Nitre	160	
Bone meal	187	

Cultivators in Kánara were advised to use fish manure for sugarcane. This manure worth about Rs. 600 has been used in Kumta Táluka during the year under report.

31. The following implements were distributed:—

Kind of implement.	Number sold.	Remarks.
Meston plough (complete) ...	20	
Meston plough (iron parts only) ...	14	
Spare shares of Meston ploughs ...	17	
Madras plough ...	1	
Kirloskar's light iron plough ...	2	
Planet Junior Hand Hoe ...	3	
Poona pans ...	6	
Chain pump ...	1	

Agricultural Associations.

32. During the year under report, the Associations at Honávar, Kumta and Sirsi have started useful lines of work. The Associations at Dápoli, Alibág, Kelwa-Máhim and Sirsi held agricultural shows.

Demonstration Plots.

33. The Associations at Honávar and Sirsi have started their own Demonstration Plots. The Kumta Association will start a Demonstration Plot in the current year. It is expected that other Associations also will gradually take up demonstration work. Cropping schemes suitable for Demonstration Plots in the several Districts of this Division have been drawn up, approved by the Director of Agriculture and supplied to the Associations.

Agricultural Shows.

34. Agricultural shows with useful demonstrations were held at Dápoli, Sirsi, Pen and Kelwa-Máhim. Good results were obtained and the shows were successful.

The District Agricultural Show has now become a permanent annual itinerating fixture in each of the Districts of this Division. It has been already held at different Táluka centres in each District. One essential condition for holding a show in any Táluka or Pránt should be that the improvements recommended by the Department should be tried on a considerable scale in that tract in the season preceding the show. The show itself should be utilised for discussing the results obtained in the field in the past season and making future plans of field work. It should be organised with plenty of demonstrations and with the minimum expenditure of money.

Development of Co-operation.

35. At the Agricultural shows and also in my tours, the Co-operative propaganda was carried on and assistance given for forming several credit societies. The Kelwa-Máhim Manure Supply Society which was formed during the year under report has begun to supply oil-cake to its members who are "panmalis" and has fair prospects of achieving good results. The Maroli Credit Society in the Thána District which has made excellent progress was assisted in selecting paddy seed for the use of its members. The Sherugars, an important agricultural caste in Kánara, were organised and helped to start a Credit Society for their caste.

36. The attitude of the public was on the whole favourable towards the movement of agricultural improvement.

V. H. GONEHALLI,
Extra Deputy Director of
Agriculture, Konkan Division.

APPENDIX H.

SUMMARY OF WORK DONE UNDER THE ECONOMIC BOTANIST, 1912-13.

1.—Enquiries.

A large number of enquires, including 141 requisitions for plants and seeds were received from all over India, also from Japan, Demerara, United States of America, Egypt, etc. The number of plants sent from the Ganeshkhind Botanical Garden during the year was 49,869 in addition to several thousands of sisal bulbils and the number imported for trial 1,257. The specimens examined or identified for correspondents numbered 451, distributed as follows :—

Plant diseases	...	...	... 48
Seed samples	...	...	... 91
Grasses and weeds	...	...	... 105
Other specimens	...	...	... 207

In addition 28 disease specimens and 20 other specimens were sent on to other authorities for further opinion.

Most of the correspondents wrote for information and advice regarding fruit culture or plant diseases, and in addition to sending answers by letter, visits were paid to as many of the correspondents as possible to advise them on the spot regarding their plantations.

Twelve correspondents asked and were supplied with information regarding fibres.

2.—Education.

The Economic Botanist and his staff took their usual share in the courses given to each of the three classes of the B.Ag. course, the I.C.S. course, the short course students, and boys of the vernacular school. In addition the following pupils have undergone or are undergoing courses of horticulture at the Ganeshkhind Botanical Garden :—

Community.	Number.	Period of training.	Occupation after training.
Lingayat ...	1	One year ...	In the service of the Chief of Ichalkaranji.
Madras Brahmin ...	1	Do. ...	In horticultural business on his own account.
Maratha ...	1	One day a week for three months.	Intended for service under a mission.
Do. ...	1	One year ...	Still under training.
Brahmin ...	1	Do. ...	Do.
Parsees ...	2	Do. ...	Do.
Do. ...	1	One month ...	Studying in Agricultural College.

The one-year course given by the staff of the Ganeshkhind Botanical Garden is a thorough horticultural training comprising specially ornamental gardening and fruit and vegetable culture. Only three pupils at a time are taken and there are always more applications than can be met. It has been decided to give this course only and not to disperse the time and energy of the staff (already occupied with their research work) on many small special courses for those who wish a smattering of horticulture imparted in a few weeks. The few wage—receiving *malis* trained in Ganeshkhind Botanical Garden show no desire for private service. During the College term specimens are supplied daily to the Agricultural College for teaching purposes from the Ganeshkhind Botanical Garden.

Specimens were also supplied to other institutions occasionally.

3.—Lectures and Publications.

The Economic Botanist and his staff have lectured before various audiences at shows during the year, etc., and have contributed articles on their subjects to the Agricultural Journal of India, The Poona Agricultural College Magazine, The Journal of Linean Society, The Journal of the Bombay Natural History Society, the Memoirs of the Agricultural Department in India, the Bulletins and leaflets of the Bombay Agricultural Department, in addition to carrying on their usual duties and miscellaneous studies.

4.—Research.

The staff of the Economic Botanist specialise on certain subjects for greater efficieny as follows:—

Economic Botanist	Mangoes and grapes.
Mr. G. B. Patwardhan, B.Sc., Acting Assistant Professor of Botany.	Grapes, Pomegranate and Roses.
„ S. L. Ajrekar, B.A., Assistant Professor of Mycology.	Fungoid diseases.
„ G. S. Kulkarni, L.Ag., Assistant Mycologist.	Do.
„ R. K. Bhide, Assistant Economic Botanist.	Rice and Fodders.
„ H. P. Paranjpye, B.A., Assistant Economic Botanist.	Citrus varieties.
„ L. B. Kulkarni, L.Ag. ...	Guavas, Papayas, Figs and Fodders.
„ S. H. Prayag, B.Ag. ...	Mangoes.
„ T. Lobo, B.Ag. ...	Micro-technique.

(Mr. H. M. Chibber, Assistant Professor of Botany now Temporary Professor of Botany, Gujarat College—Water plants of economic value, Pollination of castor and jowar.)

The results reported on concerning the various subjects mentioned below are due to the workers who specially take up these subjects.

(*a*) *Fruit culture.*—The culture of the mango continued to absorb much attention. No further success in budding this fruit tree has been met with, but crown grafting, and tongue grafting by approach proved successful. Success has also been achieved in propagating the mango by the method known as layering, in which a branch with a cut in it but not severed from the tree is buried in earth till roots form. Several new varieties were planted in the garden. Experiments in salt manuring of mango trees were continued but as in previous year there seemed to be no effect one way or other. The amount given per tree was 10 lbs. common salt. The growth and transplanting of mango stocks was tested. Those growing in the field after a year measured on the average 20 inches in height while those in pots reached only 13 inches. One-year old mango seedlings stood transplanting badly, and hardly tolerated the pruning of their roots. Experiments were made regarding the germination of mango seeds with the result that planting of the "stone" when newly extracted from the ripe fruit gives a greater percentage of plants and gives them sooner than planting "stones" that have been dried some days. Comparison was made of dug and undug mango plots which have been under this treatment since 1910-11. In the undug plot 18 out of 37 plants fruited giving 423 fruits, while in the dug plot 32 out of 35 trees fruited giving 1,217 fruits. The advantage of digging is clearly marked. It is to be noted that the above figures of fruits collected were taken after about ¾ of the crop had been brought down by the severe winds of early June. Completely pruned plants have in 16 months made up their growth and borne as well as unpruned plants. It remains to be seen if the pruning will induce an increase of bearing in the future. Much experimental work and observation has been bestowed on the abnormality of the inflorescence which has been studied for the past three years. There are no conclusive results as yet. Packing experiments with mango fruits were again conducted. The results this year were in favour of an air-tight box, as many of the fruits were spoiled by rain in the ventilated box and basket. Theft also occurred from the ventilated box and basket. Crossing of mango flowers was again unsuccessful.

At Bassein comparative tests are being made of (1) seedlings in the field, (2) one-year old seedlings in the field, whip-grafted with Alphonse mango scions. (3) The same enarched with Alphonse scions. (4) and (5) same as (2) and (3) but on seedlings in pots.

Several plants of the specimen collection have flowered but none have set fruit as yet. The various growths made by the mango are being observed and labelled to find out which growths bear the flowers.

Experiments and observations were continued in budding the various kinds of oranges, lemons, and pomeloes on various stocks. This year buddings were made on the stocks of Reshami orange and Nagpur orange. Of the buddings made in previous years those on the Jamburi stock are in every way superior. They have not fruited as yet. Fruiting may occur next year when the comparison will be complete.

The various kinds of guavas grown in Ganeshkhind Botanical Garden have been observed and their life histories recorded. First layers made from certain grafted plants have now fruited and have been again layered to test whether this process reduces the number of seeds per fruit. In the Dharwar variety of guava red fruits were found to have more seeds than white fruits, which is in accordance with popular belief. The opposite was the case in the Kothrud variety however. Crosses were made between red and white fruited varieties but without success.

The observation made last year that during the rains, germination of papaya seed was speedier and of higher percentage that at other seasons, has been confirmed. It has however also been found that germination at any time of year in the hot frame produces a similar accelerated and increased germination.

The breeding of papaya from selected parents has been begun. Pollination beetween certain unusual flowers, and self-pollination of these was resorted to for investigation of the inheritance of these peculiarities. The general observation made last year that the sex of papaya flowers gradually change from male, through hermaphrodite, to female, has been confirmed by more exact studies.

Grafts of Kábuli Pomegranates were made and one of these flowered giving a flower of darker red than the Poona variety. The quality of the fruits will be reported on later. Spraying with crude oil emulsion, and with tobacco water were used to reduce the attack of the boring grub known in Marathi as "Sursa". In plants sprayed with crude oil emulsion the percentage of attacked fruits was 5·7, in plants treated with tobacco water 1·35 and in untreated plants 14·9. This tends to show that the crude oil emulsion treatment is the more effective.

A manurial experiment to test the effects on grape vines of various combinations of manures was laid out. The results are not yet conclusive but the following combination gave hopeful results: (1) Fish manure 8 lbs., mixed with Sulphate of potash 1 lb., per tree; and (2) Safflower cake 8 lbs., Bone meal 2 lbs., per tree.

The local varieties of figs were studied as to flowering time, growth, etc. Foreign varieties of figs seem at last to be becoming acclimatised and a few of their fruits reached maturity.

Observations were made on Custard Apples and other minor fruits.

Plantains from Bassein (on the coast) were in 1911 planted for trial in the Ganeshkhind Botanical Garden. The following varieties died out: Sahasraphali, Red, Rájeli, and Basrai. The following fruited: Bankel, Govegiri, Kanher, Kurjel. Kanher and Kurjel were most successful.

(*b*) *Plant Diseases.*—The Assistant Professor of Mycology taught the usual courses on fungoid diseases of plants to the B. Ag. and Short Course students, and reported on diseased specimens sent for examination. In addition to some pure scientific work on a diseases of a species of jasmine, he made a close study of castor rust, and a papaya disease. Important work has been begun on a soil fungus, Rhizoctonia, which is the cause of wilting of potato, Suran (Amorphophallus) and Pan.

The Assistant Mycologist devoted a large part of his time to experimental spraying of Supári palms at Sirsi and Siddapur for the Koleroga disease of the nuts. The treatment consists in the application of a liquid containing copper sulphate, quick-lime and dissolved resin. The liquid is put in special spraying machines worked by compressed air, which are strapped to the backs of men who climb the trees and apply the mixture in a fine spray through special tubes and nozzles. This work was carried on in spite of considerable difficulties and the results are promising, the advantages of spraying over the local method of Kotte-tying being clearly demonstrated.

The Assistant Mycologist toured also in the sugarcane areas to examine the plantings of disease-free canes made last year, to distribute more such canes, to further popularise methods of combating the red-rot disease of sugarcane and to study the disease generally. He has also done important work on diseases of jowar, bájri, rala and Acacias, and has found a new disease on the supári palm.

There is every sign of the increasing popularity in Násik District of the spraying of grape vines in Násik against mildew. This method was introduced by the Economic Botanist three years ago. The liquid used for this purpose is similar to that used for Koleroga but weaker and with soap instead of resin. For this popularity much credit is due to the late Rao Bahadur Gole and his brother Mr. H. V. Gole who is carrying on the work with enthusiasm.

(*c*) *Fodder.*—In Ganeshkhind Botanical Garden plots of selected wild grasses were again sown to get seed and specially to observe the behaviour of the plants during the hot weather. Ten species remained green throughout that time, some of which will be selected for sowing in very dry commons. A study of common lands (Kurans) in the drier tracts of the Presidency was also made during the hot weather to find out what grasses did survive there. In the rains of 1912 an examination of the wild green fodder supply of Poona was made by purchasing head loads of fodder and analysing them botanically. The greater part appeared to be only weeds plucked out from the fields and garden crops, the rest is probably obtained from the hill sides. A list of the species found was made and such as were in appreciable quantity were sent to the Superintendent of the College Farm for feeding to cattle and reporting on the liking or aversion shown by the animals. Among the grasses seven species were found to be greedily devoured. This information will be useful for further work on pastures.

Five of the wild grasses sown in the rains of 1911 still persist and gave good crops, showing their drought resistant and perennial character.

(*d*) *Rice.*—The first botanical problem in connection with rice is the classification of the numerous varieties. This is a task of some difficulty since there is an extremely fine gradation of characters in the varieties, and moreover physical conditions seem to affect these characters considerably. The work done so far has been to collect a great number of varieties and grow them at one place. This was first Lonavla and is now Alibag. These are this year grown from one selected head of each variety so as to have "pure lines," *i. e.*, absolutely unmixed strains by which to judge the varieties. Pot culture trials have also been made to test the effect of drained and undrained conditions on varietal characters. Plantings of pure lines have been made also at Gokak and Surat for the same purpose. All this work is necessarily slow but the result is certain, namely, a complete and useful classification of all the rice varieties of the Presidency and a knowledge of how these vary with varied conditions. Such knowledge is the basis of future purely agricultural investigations.

(*e*) *Weeds.*—A collection of weeds is being made and their vernacular names recorded with information as to their nature and habitats. This will be put together into book form later. A collection of weed seeds is also being made.

W. BURNS,
Economic Botanist

APPENDIX I.

REPORT OF THE AGRICULTURAL CHEMIST FOR THE YEAR 1912-13.

1. The office and laboratory of the Agricultural Chemist to the Government of Bombay have been under my charge during the whole year under review except from March 29th to May 30th 1913 when I was on privilege leave. During this time Mr. W. Burns, Economic Botanist, was in acting charge of work.

2. The routine analytical work of the laboratory still shows a tendency to increase. If we exclude the year 1909-10, when special circumstances caused an enormous number of samples of milk to be examined, it is the heaviest year that the laboratory has had. The following table shows the gradual increase in the analytical work of the laboratory since it was founded in 1906.

Kind of samples.	Number of samples received.						
	1906-07.	1907-08.	1908-09.	1909-10.	1910-11.	1911-12.	1912-13.
Soils	67	101	311	347	281	378	219
Manures	43	105	91	205	184	195	251
Feeding stuffs	17	41	17	107	33	114	208
Water	22	80	266	403	328	362	609
Gul and sugar	32	76	7	56	10	5	4
Beet root	...	...	36	11	1	...	...
Oil seeds and oils	47	98	146	278	190	72	151
Milk	233	666	257	546	73	206	152
Condensed milk	...	...	2	...	1	...	...
Cream	123	1	1	...	...	...	1
Butter and ghee	2	2	2	16	12	...	4
Tapioca	...	...	...	46	9	...	...
Miscellaneous	10	22	17	104	94	91	62
Total ...	596	1,192	1,153	2,119	1,216	1,423	1,661

3. The real test of the success of the laboratory in filling a public need is best shown however by the use which is made of it by the public—both by actual cultivators and by those responsible for industries directly dependent on agriculture. The number of samples received for analyses from the public, as distinguished from those from Government farms and departments, has regularly increased from year to year, as the following table of such samples shows, the figures being given since 1907-08.

Kind of samples.	1907-08.	1908-09.	1909-10.	1910-11.	1911-12.	1912-13.
Soils	15	14	23	59	81	128
Manures	12	11	11	73	54	131
Feeding stuffs	3	2	17	11	45	56
Water	11	16	15	38	31	28
Gul and sugar	...	...	...	...	4	4
Oil seeds and oils	...	...	...	...	20	31
Milk	...	4	17	2	7	98
Cream	...	...	...	...	...	1
Butter and ghee	...	...	13	10	...	2
Miscellaneous	...	...	41	56	34	47
Total ...	41	57	137	249	276	526

4. I referred in my report last year to the establishment of an oil seed pressing industry in Western India, and the fact that assistance was not unfrequently being given in the analyses of samples both of materials and products. This industry is now developing comparatively

rapidly, and especially in the direction of preparing groundnut and safflower oils in the districts where these seeds are largely grown. This year has seen the establishment of several new mills for the extraction of oil, among others in Kolhapur, Sangli, and Bijapur, and the movement will probably extend. This is a development which has been desired for many years by almost all who have written on Indian agricultural matters, chiefly with the idea of keeping the oil cake produced in the country, and utilising it for manure, either directly or indirectly by feeding it to cattle. There is now little doubt of the success of the industry. The cake normally produced in the case of groundnut (where we have most experience) contains about seven per cent of oil or a little over, showing fairly good extraction. At present, however, the demand for the cake is for export. Local Indian requests for it are totally insufficient to take the produce of the mills. And, in connection with this export demand, the quality of the cake exported, especially its liability to become mouldy owing to its being sold and exported in a moist condition, has been a matter of considerable interest during the year. The danger that the trade will be injured on account of this liability to become mouldy has become so serious during the year that I called the attention of the trade to the danger in an article in 'Indian Industries' some months ago. The matter is a serious one, and it is very important that a new trade should not be throttled by carelessness in this matter in the beginning.

The local demand for oil-cake expands only slowly, and then chiefly for manure. All the castor cake that can be made can be utilised in connection with sugarcane manuring, but other cakes are not so easy to sell. I think it is only a matter of time before a large demand does spring up for such excellent foods as groundnut cake, safflower cake, and others, but it *will* be slow especially in view of the high prices which are paid for export to Liverpool, Antwerp and Marseilles, but the increase in demand will be slow.

There is necessity, just as in the case of the cake for export, to call attention to the danger of mouldiness in cake badly stored in India. I had a case before me in January last of dysentery in cattle undoubtedly caused by mouldy groundnut cake. The cake in question contained over one per cent. of acid, which shows how mouldy it had become, and under these circumstances the cake may be very injurious.

There has sprung up a large inquiry for some of the lower grade products of oil pressing, such as the cotton seed husks obtained in pressing cotton seed, where all that are made can be sold at paying prices for feeding milch cattle.

I called attention in my report last year to the extent to which adulteration of vegetable oils with mineral oils is now taking place in Western India, as revealed by the work of my laboratory during the year. I would again bring the matter to notice. It is most marked in the case of cocoanut oil, where it is almost impossible to buy an unadulterated sample in the bazaar at present, but it is not limited to that oil. The adulterant used is a white mineral oil, carefully deodorised, which is specially imported for the purpose. The cause of this is undoubtedly the large increase in price of vegetable oils in recent years, but it is neverthless a serious matter. When one sample of cocoanut oil bought contained fifty seven per cent of mineral oil the matter has reached a serious position.

While speaking of this subject I might give an analysis of *kuwadia* (*Cassia tora*) seed recently made in my laboratory, where it was sent as a proposed feeding stuff. The seed is very common, and when roasted makes a very passable substitute for coffee, but I am not aware that it is used as a feeding stuff. It has an objectionable taste but according to my tests it is not injurious to animals—and hence under famine conditions will be worth collecting and using. The analysis of the seeds gave the following figures:—

	Per cent.	
Moisture	10·40	
Oil, etc.	6·45	
Proteids	17·75	(containing Nitrogen 2·84 per cent.)
Digestible carbohydrates ...	51 75	
Woody Fibre	9·50	
Ash	4·15	(containing sand 0·05 per cent.)
	100·00	

5. I cannot help referring to the change in the character of the safflower cake on the market as a result of the development of a mill industry. Cake pressed in a country *ghâni* has to have the greater part of the husk (which amounts normally to fifty per cent. of the seed) removed before it can be properly pressed—and hence the cake obtained is very rich, usually containing from six to eight per cent. of nitrogen. It is on the basis of such cake that much has been written in recent years as to the extreme value of safflower cake as a manure for sugar cane. When the same seed is pressed in a power mill it is naturally the desire of the manufacturer to incorporate as much as possible of the husk—otherwise quite worthless except for burning, in the cake, and the result is that mill cake is relatively very inferior and usually only contains about four per cent of nitrogen. So that on the basis of nitrogen content—the best test of manurial value for sugar cane that we have—the cake is only a little more than half the value of that produced in the country *ghânis*. Both kinds of cake are on the market, and it is important to recognise the fact.

6. Among other experiments on feeding stuffs done during the year was an interesting test made for the bacteriological laboratory Parel, as to the possibility of the absorption of hydrocyanic acid by grain, especially rice, when the latter is fumigated with this gas as a precaution against plague. I found that no absorption takes place, that the value of the grain as a food or as a seed is undiminished. This fact is of considerable importance in view of the suspicion with which rice has sometimes been regarded which is exported from centres where plague occurs.

7. In the search for new foods and fodders, two materials have been examined during the past year. The first of these is the seed of the *rozelle* plant *(Hibiscus sabdariffa)* well known in India as a fruit. This seed, like other members of the genus Hibiscus gives an edible oil, and the cake left behind on pressing in a country *ghani* gave the following composition.

	Per cent.	
Moisture	8·10	
Oil	9·60	
Proteids	24·50	(containing Nitrogen 3·92 per cent.)
Digestible Carbohydrates ...	30·85	
Woody Fibre	17·50	
Ash	9·45	(containing sand 2·60 per cent.)
	100·00	

It is evidently a fairly good food, and although, owing to the hard seed coats, it would have to be fed with care, there is little doubt of its value when available.

Another possible food is the tubers of the plant common in the Konkan termed *kudu tondli* (*Cephalandria indica*). These are bitter and on this account of little value. On boiling with water most of the bitterness is removed, and the tuber can then be eaten without injury. The boiled and dried root had the following composition:—

	Per cent.	
Moisture	3·25	
Oil, etc.	2·35	
Proteids	15·01	(containing Nitrogen 2·41 per cent.)
Digestible Carbohydrates ...	51·99	
Woody Fibre	15·95	
Ash	11·45	(containing sand 0·40 per cent.)
	100·00	

8. One of the marked features of the market for concentrated manures during the past year has been the decline in the demand for oil cake, and the increase in the demand for fish. I think the result has been largly due to the increase in the price of oilcake owing to the export demand, but it has also been affected by the organisation of the supply of fish to the tracts using large quantities on the Deccan. The price of fish has hence fallen from that prevailing in previous years, but, as almost always occurs in India when demand increases, the quality has gone down at the same time. In former years the percentage of nitrogen in samples sold varied from seven to nine: this year most of the fish has only contained from five to seven per cent. of nitrogen. This may lead to some disappointment in its use. The fish has been mostly obtained from the Malabár coast.

9. The usual large number of samples of soil and water have been analysed for cultivators in the greater part of the country. The problems which have arised are similar to those mentioned in previous reports. In the case of soil it is usually a question of the manuring required for particular crops, or else a general question of decreasing fertility or the development of salt in the land. In the dry areas of the Deccan for instance, where well irrigation is employed, it is astonishing how frequently a decline in productiveness in soil is a sign of increase in salt. Samples of water are very frequently examined, usually as to their suitability for irrigation.

10. What have been cited are just a few examples of the kind of problems which are now continually coming before me, and I only quote them as such. The laboratory is being used to a continually increasing extent for inquiries regarding such problems.

11. At the same time as my laboratory tries to examine and advise in connection with samples which are sent in for such examination, equally important is the work done on investigations originating here. During the past year such investigations have been actively continued. The first paper on the work which has been done regarding the betel-vine (*Pan*) leaf—perhaps the most important garden crop in India—is now been published as a Memoir of the Department of Agriculture in India. This work has been undertaken ultimately to ascertain whether the quality of the leaf cannot be improved by modifications in the methods of cultivation and preparation for the market. The work on this subject is being continued. A paper on safflower oil will be shortly ready for publication. And two long papers on the agricultural well waters of the trap area will be ready for issue soon.

The research work, beyond that already indicated, now in progress, is, in summary, as follows :—

(1) A continuation of the work previously indicated on the *'rab'* system of rice cultivation.

(2) A continuation of the study of the salt and *kari* lands of the black soil of Western India, and their reclamation.

(3) A study of the milk supply of cities in Western India, being really a continuation of work previously done on the milk of Indian cows and buffaloes.

Progress is being made in all these directions, as well as in connection with some minor problems which there is no need to detail.

12. My staff has worked well during the year. Mr. V. A. Tahmane, B. Sc., L. Ag., has remained Senior Laboratory Assistant throughout the year. Mr. N. V. Kanitkar, B. Ag., has been transferred from the position of Junior Laboratory Assistant to be Lecturer in Chemistry in the Agricultural College, and his place has been taken by Mr. D. M. Ranade, B. Ag., while Mr. D. D. Abhyankar B. Ag.—a hard and accurate worker—has been added to the laboratory staff.

HAROLD H. MANN,
Agricultural Chemist.

APPENDIX J.

ANNUAL REPORT OF THE AGRICULTURAL ENGINEER, BOMBAY PRESIDENCY, FOR THE YEAR ENDING 30TH JUNE 1913.

INTRODUCTORY.

During the year under review the post of Agricultural Engineer has been filled by three officers.

Mr. Musto, the first officer in charge, reverted to the Public Works Department on the 6th of November last, and officiated up to that time both as Agricultural Engineer and Mechanical Engineer.

He was relieved by Mr Thiselton-Dyer on the above mentioned date.

Mr. Thiselton-Dyer, too, officiated as Agricultural Engineer and Mechanical Engineer for about three months.

Then I took over charge of this office and relieved the last named officer during the last week of January 1913.

I was at once convinced, after carefully perusing its records, of the growth and tremendous possibilities of this department.

Realizing this, it was pleasing to know that I could devote my whole time to this very important work.

It was fairly obvious that many new subjects were being introduced, a fact which will be quite patent after a careful study of this report.

The one outstanding feature, of course, is the keen interest shown by the cultivators, in their desire to take advantage of the help rendered by this department in showing them the possibilities of new and improved machinery and especially of power driven machinery.

They are especially considering this question from a financial point of view, which is of course most vital to their interests.

PUMPING.

This particularly applies to pumping: although it is considered in connection with other branches of agriculture, still it appeals to them more from a pumping standpoint than any other at present.

Now it is worthy of note that many more enquiries have been received for pumping from rivers, than from wells, and although some were impracticable most of them were ideal.

It must always be remembered especially in the case of river sites, even if the lift is rather high and floods severe, the land under command can be greatly increased, provided suitable machinery is erected and the land under consideration be cultivable.

Of course it is advisable to have as low a lift as possible.

This is a most important point, especially so, if the area to be watered is small.

Another important point is that there are no two sites alike: each individual site must have especial care bestowed upon it.

There is no such thing as precedent; each site having its own peculiar conditions.

It is apparent from this then that pumping is still the great subject for this department to grapple with, and it is in this direction that the most interest is shown.

The possibilities of this branch of the work are immense.

I believe it is, and always will be, the most important subject; hence it is this, which has, and will have, my most earnest attention.

It is also gratifying to be able to record that well owners continue to enquire as to the possibilities of irrigation by means of power pumps.

Evidently the cause of this cannot be restricted to one source.

Labour is becoming more scarce; kadbi, gram, and other rations have risen to double the price they were a decade back.

And all these tend to create an interest in the endeavour to replace cattle water lifts by means of engine and pump.

A large number of enquiries have been received this year and in most cases estimates for suitable plants have been given and I believe a large number of these plants will be erected in the course of next year.

Some of them are now under construction and will shortly be complete.

Unfortunately in the case of wells the water-supply is restricted and consequently a limited area is under irrigation.

But where the water-supply is sufficient and the total lift not more than 50 feet, then irrigation by means of centrifugal pumps is most profitable from 20 acres upwards.

It must not be forgotten that when a comparison is being made between cattle lifts and pumping plants, that one mhote can only irrigate 3 acres of sugarcane, whereas by engine and pump 20 acres may be considered a small item and can be watered at much less cost per acre per annum.

In this connection the 2½″ high efficiency pump mentioned in last year's report, has been installed in one or two wells and a report of its work will shortly be published.

At present I am unable to give any accurate figures of its capabilities, but I certainly consider it a most suitable pump for wells and it will meet a long felt want.

For this class of pumping and especially in the case of a well or river having a fairly quick rise and fall in the static head, I am introducing an entirely new design of pump which will obviate the necessity of making any adjustment for the various levels during pumping.

The first of this kind of pump will be tested at the college workshops and a report of its behaviour under test will be published at a later date.

One important point which deserves mention here is the increase in number of enquiries from Sindh; until recently they have not paid much heed to this department but enquiries are now steadily on the increase.

Ninety-one pumping enquiries have been received from various parts of the Presidency and may be summarized as under:—

Enquiries from Northern Division	...	...	15
Enquiries from Central Division	...	...	30
Enquiries from Southern Division	...	...	46
			91

Pumping from well	...	39	85 of these surveyed.
Pumping from river	...	52	
Number of enquiries	...	91	

Enquiries from all sources, 157 which may be divided as under:—

Pumping	...	...	...	91
Cane crushers	...	...	...	8
Boring	...	...	...	34
Blasting	...	...	...	7
Water-finder	...	...	...	5
Cotton gins	...	...	...	4
Power plough	...	...	...	3
Wind mills	...	...	...	3
Oil mills	...	...	...	2

8 sites surveyed.

From the number of enquiries stated above, it will be seen that there is a steady increase and consequently a corresponding increase in surveys, preparing of estimates and erections to follow.

Boring.

Boring, of course, comes next in importance and has received an impetus owing to the fact of a new patent boring machine being introduced, which is the invention of my predecessor Mr. Musto.

This machine has been tested under severe conditions and has proved itself a highly efficient one.

I anticipate great things from this machine, feeling assured that it will be a boon to the people at large.

A very severe test of its capabilities was recently made at Jeur Station, G. I. P. Railway, in a disused well which consisted of trap rock.

This strata was exceedingly hard, but notwithstanding this I was able to reach a depth of 50 feet in 16 days.

This bore-hole was 3″ in diameter, and considering the particular geological formation to be dealt with, I consider the result an exceptionally good one and it reflects great credit on Mr. Musto's invention.

My past experience of hand boring tools which is wide and varied, enables me to assert that this is a splendid tool.

The average charge per foot for actual boring in trap rock at Jeur was Rs. 1-5-5.

After completing the well at Jeur this machine was taken to Dhond and there bored a 3″ by 20 feet hole for Mr. A. Norton.

After completing this work I solicited an opinion from him, an extract from which is appended below:—

"Yours of the 30th ultimo received. Your boring machine did good work with us, drilling a hole 3" in diameter some 20 feet deep from the bottom of the well where the formation of the layers of murum and rock are favourable to obtaining water.

I believe the machine will be of decided value."

From these two cases it will be seen that boring in the Deccan is not only possible but practicable.

It must be understood that tests are being made with this machine and special tools designed, which will not only reduce the cost of boring, but will revolutionize hand-boring in the Presidency.

It is my intention to make many experiments with this machine and get the best possible results in the least possible time; then if water supply can be augmented by first of all boring and afterwards blasting, this machine will, to a large extent, be responsible for such a change.

Therefore the possibilities of blasting will be considerably enhanced by the introduction of such a machine.

Blasting.

Experiments are about to be made with blasting and a special staff will be trained, to enable me to control this particular branch of work in the Department.

I hope to be able to give some interesting figures in this connection during the coming year.

Gujarát.

The special report for Gujarát will show that boring operations in that district are a separate branch of the Department; hence its work is embodied in a special section of this report, but it must however be mentioned that Musto's patent has done very good work here: boring at least three times as fast as the Cawnpore sets or about 30 feet per day in very soft soil and in consequence reducing the cost considerably for boring operations.

Deccan.

Thirty-four enquiries have been received from the Deccan, but this will considerably increase as the people become aware of the possibilities of boring in trap rock, which hitherto has been considered impracticable.

Cane Crushing.

Eight enquiries have been received and replies and estimates given.

Cane Crushers (power) are now working at several places in the Presidency and I do not think it necessary for me to dwell on this subject at any length.

It is worthy of note however and it is generally admitted that the average cultivation of sugarcane in India is excellent.

Now most of the small growers of sugarcane who require to deal with from 20 to 25 cwts. of sugar per diem, use the old country mill for the purpose of grinding.

This quantity is not enough to justify the initial cost and running expenditure of a steam mill and boiler.

The situation can, however, be met by the installation of a horizontal mill driven by an oil motor.

These mills are easily and cheaply worked and give excellent results, forming a great improvement on the native crushing plant.

Data on the subject of extraction are conflicting, but it is doubtful judging by similar work carried out elsewhere, whether 60 per cent. is not too high a figure to assign to the average extraction by these old country mills, whereas 80 per cent and more is recoverable by modern milling.

It will be obvious from this then that milling by means of power and modern methods is highly advantageous and, if the prospective cultivator, who is thinking of installing a pumping plant and who is going to grow sugarcane, can arrange for the erection of a suitable cane crusher at the same time or leave a margin for erection later on, his prospects will be indeed brighter than hitherto.

One enquiry is likely to mature and when complete, the plant will be an ideal one.

The owner also wishes to extract oil from various seeds etc.; but full particulars of this will be forthcoming at a later date.

Steam Ploughing.

Three enquiries have been received during the year under report, and advice and estimates have been given, but from the information available it seems that the ordinary cultivator cannot purchase an efficient steam ploughing plant.

It is, however, essential to the Agricultural Community, and to agriculture generally, that the public shall have a practical demonstration of steam ploughing, and so be able to judge of its advantage in the Presidency.

Having the agriculturists' interest at heart, the Sir Sassoon David Trust provided the funds for the purchase of a complete steam ploughing set from Messrs. Fowler and Sons, Leeds, England, who have a worldwide reputation for this particular class of work.

This firm has undertaken to supply a skilled engineer who will train local men to use this machinery properly.

The plant is expected in India shortly and will be ready for work about September.

It is proposed however to train men from my own Department and the demonstration proper will take place in November.

If this enterprize proves successful Government may be disposed to purchase additional sets to work in other Districts.

And it is hoped a few enterprizing cultivators may be found who will associate themselves for the express purpose of purchasing a set of ploughing tackle. This may be arranged by means of a syndicate, and the project conducted on business lines.

I am given to understand that thousands of acres of black cotton soil are lying waste in the Dhárwár District alone, only waiting for suitable machinery and enterprize to transform them into profitable cultivation.

This is regrettable, and it is hoped that by a systematic use of suitable machinery, this state of things will soon be a thing of the past, and consequently bring about innumerable benefits to the whole community in that immediate vicinity.

Many tracts of good fertile soil now lying waste may by means of the steam plough be brought under cultivation.

Before concluding I must say that although the initial cost of the plant is heavy, its maintenance charges will compare favourably with smaller plants, if the set is fully occupied, which should be an easy matter; for instance, work other than ploughing can be done, such as hauling, threshing and pumping.

Wind Mills.

Three enquiries have been received but none are likely to mature; of course it need hardly be mentioned that very special conditions are absolutely essential for pumping by means of wind mill, hence I do not anticipate great things in this direction.

Oil Mills.

Two applications have been received from enterprizing cultivators for this class of machine.

Advice has been given and one enquiry is likely to mature during the next few weeks.

I hope to be able to give a more elaborate report in this connection next year.

Cotton Gins.

This is a branch of work which is likely to develop in the near future.

Several cotton growers complain of losing much for want of their own gins.

Whilst touring I have been able to make enquiries as to the cause of their trouble, and find that the large ginning mills care little for the small cotton growers' products.

The result is these small cotton growers are severely handicapped.

In many cases the cultivator has a pumping plant which consists of oil engine and pump, but as the plant is not run all the year round, other duties are sought after by the owner for the engine to perform.

Now where cotton is grown on a small scale, and the cultivator has his own engine, the supplementing of a cotton gin would certainly be advantageous; especially if there are others in that vicinity who would patronize his machine by sending him their products to be ginned.

The question of initial outlay of course must be considered and is heavier to the extent of from 200 to 300 rupees.

Many owners of power pumps are anxious to supplement their plants by the introduction of a gin, or cane crusher as the case may be; and thus find full employment for their engine.

This is an excellent plan and one which I strongly advocate.

Plants owned by the Department.

Málegaon, Poona District.

26 B. H. P. Oil Engine and one 6-roller Cane Crusher, and Juice Pump.

Mánjri, Farm, Poona District.

18 B. H. P. Oil Engine, and Cane Crusher, with Juice Pump.

Nangaon, Poona District.

37 B. H. P. Gas Engine, and 2 high efficiency Turbine Pumps and 2 Auxiliary Pumps.

Ganeshkhind Gardens, Poona District.

8 B. H. P. Oil Engine and 3″ Centrifugal Pump.

Dhárwár.

6½ B. H. P. Oil Engine, one 2″ Centrifugal Pump, one 3″ Rotary Pump, and one Cotton Gin.

Surat.

6½ B. H. P. Portable Oil Engine, and two 2½″ high efficiency Centrifugal Pumps.

One 6½ B. H. P. fixed Oil Engine with Rotary Pump, Cotton Gin and Chaff Cutter.

Nadiád, Kaira District.

6½ B. H. P. Oil Engine and a 2½″ Centrifugal Pump.

Gokák, Belgaum District.

14 B. H. P. Oil Engine, Cane Crusher, Juice Pump and 3″ Centrifugal Pump.

It is proposed to demonstrate at Surat the advantage of a Portable Oil Engine and show how 2 or 3 pumps can be worked with the same engine.

The whole plant will shortly be complete, and the demonstration can then take place, particulars of which will be sent to interested cultivators, who, it is hoped, will take full advantage of this opportunity to judge of the possibilities of motive power as applied to agriculture.

I am re-modelling the plant at Nadiád, which has given a great amount of trouble since its erection; This is owing to its being poorly designed in the first place, and proves conclusively the truth of my predecessor's remarks in his last report as Agricultural Engineer: where he says that if a plant is properly designed, and erected in an engineering manner, scarcely any trouble is experienced afterwards, unless it is from some unavoidable source, or from bad maintenance, and the last evil will soon be a thing of the past, when the present proposals of erecting a workshop are put into practical shape which, I hope, ere long will be realized.

By unavoidable source, I mean land-slip caused by severe floods, flaws in certain castings, etc.

Gokák.

This plant is practically ready now for demonstration work, which the Assistant to the Deputy Director of Agriculture is anxious should take place to show the advantages of machinery by motive power over animal power and the country methods.

This should be an ideal plant as the engine is designed to drive cane crusher, juice pump, and centrifugal pump.

Agriculturists should make use of this demonstration and erect suitable and similar plants at their own sites.

PLANTS ERECTED BY THIS DEPARTMENT FOR PRIVATE OWNERS.

Turmuri, Belgaum District.

8 B. H. P. Oil Engine and 3″ Centrifugal Pump. This plant has been working since June 1912 and has given entire satisfaction.

Only a slight leak temporarily disabled the pump for a short time.

As soon as the trouble was reported to me, I despatched one of my men with instructions what to do immediately, and within a few hours of his arrival at the site, the pump was made to work.

This is the sort of thing I am endeavouring to eliminate shortly, the method of which I give a description later on in this report.

Naginhal, Belgaum District.

One 8 B. H. P. Oil Engine and 4″ Centrifugal Pump. This plant was completed in February last and is now working beautifully.

Dhulia, West Khándesh.

10 B. H. P. Oil Engine and 3″ Centrifugal Pump and a 2½″ new type Centrifugal Pump now under construction.

This work has been delayed owing to the cultivator being anxious to carry on excavation work in his well.

He has not been able to finish this work satisfactorily, therefore I have decided to complete the whole of it through this Department and finish the job after the rains.

Here is another case where the owner is desirous of fixing cotton gins.

Biludi, East Khándesh.

One 10 B. H. P. Oil Engine and a 4″ Centrifugal Pump.

This plant is now working to owner's satisfaction. The great trouble here is owing to the river drying up between the months of April and June.

It is proposed to erect gins at this site and so make use of the engine when not pumping.

PLANTS UNDER CONSTRUCTION.

Turmuri, No. II, Belgaum District.

20 B. H. P. Oil Engine and a 6″ Centrifugal Pump.

The erection of this plant will commence after the rains.

This work has been at a standstill owing to the great delay in despatching machinery; and the owner's inability to get suitable material to the site.

The rains are heavy in this district and I have purposely postponed the erection work until the rainy season is over.

Ankli, Belgaum District.

One 22 B. H. P. Oil Engine and a 4″ Centrifugal Pump.

The Pump only arrived at the site at the time of writing and the erection work has been delayed owing to the blasting operation not being complete.

Boring and blasting operations have now been handed over to me and the work will be resumed after the rains.

Ode, Kaira District.

One 8 N. H. P. Steam Boiler and Duplex Pump.

This plant is altogether different from those previously mentioned in this report and is the first one of its kind to be erected by this Department.

Surat Government Farm.

One 2½″ Centrifugal Pump.

Agricultural College Farm, Poona.

The erection of various type of lifts and pumps for experimental purposes.

Government Civil Dairy, Kirkee.

Complete installation of modern dairy plant.

Jalgaon Government Farm.

Oil Engine, Cotton Gins, Pump, Chaff Cutter, and Winnowing machine.

Workshop and Training School situate in the Agricultural College grounds, Poona.

One 14 B. H. P. Oil Engine.

One 16 B. H. P. Oil Engine.

Two Lathes, one Drilling machine, one Screwing machine, Grindstones, Emery Wheel and Blower.

Two Centrifugal Pumps of the latest pattern, with stand pipes, meters and all accessories suitable for a modern training school.

Nadiád Government Farm.

One medium lift pump.

Suitable mountings for Steam Boiler used for drying purposes.

The works completed and on hand will show that there is steady increase in the erection work of my Department.

SCARCITY OF SKILLED MEN.

This is indeed a want keenly felt by this Department, a fact which I have proved many times since taking up my appointment, and to counteract it I have proposed the establishment of a workshop and training school, the erection of which has now commenced.

In this shop I shall show those interested in agriculture, and particularly those who are cultivators and who wish to understand the oil engines and pumping machinery they already possess, the proper way to attend to their plants, *i.e.*, to take the various parts of the engine to

pieces, clean off the carbon, grind the valves in, and make the necessary adjustments and so obtain the best possible results, without having to engage special men from Bombay.

In other words they will have demonstrated to them the proper and engineering way to erect, and run a pumping plant.

They will also take part in repairing other machinery such as improved implements, and will, in a short time, become fairly competent to use such tools as are necessary to put a temporary stoppage right.

It will also tend to create an interest in the improved methods of cultivation, and so eliminate the old prejudice which has so long prevailed in this country.

In this training school I anticipate the creation of a class of men from which I can choose drivers, who in time will do justice to the plants assigned to their care.

This may not appear at first sight to be of much importance, but I have been able to trace the cause of a break down, and serious stoppage, to the fact of a poor driver being engaged to look after the plant; I hope therefore by means of this school to entirely dispense with this evil.

My mechanics will also become more skilled in erection work, and in the location of oil engine troubles.

I shall deal entirely with the practical side of the question knowing from experience that it is the most essential, and so far the less known in this class of engineering.

It is not proposed to make engineers of all and sundry, but simply to instruct those anxious to know how to handle their own pumping plants, and agricultural machinery generally, and so enable them to take proper care of the same.

A nominal fee only will be charged to intending students and rules relating to this matter will soon be published and full particulars given.

Principal Divisions of Work.

The work of this Department may be divided into two classes:—

1.—Advisory.

2.—Executive.

1.—Advisory.

The advisory work consists of answering enquiries, giving advice, and preparing estimates for various kinds of work, the extent of which may be gathered from the particulars given of the work under construction, the number of enquiries received and dealt with, and the diversity of subjects already described.

Most of the advisory work cannot be done, unless a survey is taken of the site where it is proposed to fix the machinery; and although much has been done to enable cultivators to choose a good site, and understand the fundamentals required, before the installation of machinery is possible, nearly all the sites necessitate a visit before an estimate can be submitted; therefore much touring has to be done in consequence.

2.—Executive.

Executive work consists of touring, and inspection, taking tests, etc., a description of which I give below.

Inspection and Survey Tours.

Before I joined this Department much touring had been done by Mr. Musto and Mr. Thiselton-Dyer, and I found that still much more was necessary. I therefore set about this branch of the work and commenced my first tour in February which has been continued up to the time of writing.

I have endeavoured to arrange my visits to the various sites in such a way that will dispense, as far as possible, with unnecessary waiting at any particular site; otherwise much time would be wasted, and the work generally handicapped. If a tour is well arranged, surveys and inspections can be made almost every day, with just an occasional day for office work, as this accumulates and cannot be dealt with for long without a special day set apart for its despatch.

Account of Private Money.

From the information obtainable during my tour, and looking at this matter in the light of recent events, I have come to the conclusion that many cultivators are not quite sure of the business methods adopted by this Department.

I have been able to dispel these doubts on the spot in some cases; but for the benefit of those who are not quite sure of this point, I now take advantage of this report, feeling assured by so doing, that any misunderstanding which may exist will at once be cleared away.

Directly any money is received into my office I pay it into the Bank of Bombay (Poona Branch) and an account for the owner of the particular site and the machinery under construction is opened. I then draw cheques on this account and pay for the machinery I have ordered, and for any other expenses that may be incurred during erection.

Most of the firms quote me at special trade rates and the benefit of this commission is credited to the owner's account.

After the work is complete a detailed account of payments in connection with each item is made out and sent to the owner.

As an example of this proceeding, I give below a copy of the account of Mr. Sangangauda Ramangauda Patel of Naginhal :—

Mr. Sangangauda Ramangauda Patel of Naginhal, táluka Sampgaon, district Belgaum, in account with the Agricultural Engineer, Bombay Presidency, Poona.

Debit. *Credit.*

Date.	To goods.	Invoice No.	Amount.	Date.	By cash.	Amount.
			Rs. a. p.			Rs. a. p.
1st February 1912 ...	To goods Messrs. Marshall Sons & Co., Bombay.	337K	20 0 0	29th March 1912 ...	By cash ...	1,900 0 0
12th March 1912 ...	To goods Messrs. Richardson and Cruddas, Bombay.	481	24 0 0			
1st February 1912 ...	To goods Messrs. Marshall Sons & Co., Bombay.	335K	1,143 12 0			
Do. ...	Do. do. ...	336K	210 0 0			
18th March 1912 ...	Do. do. ...	863K	99 2 0			
12th April 1912 ...	To goods Messrs. Richardson and Cruddas, Bombay.	4144	1 8 0			
31st May 1912 ...	Do. do. ...	6512	173 6 0			
20th July 1912 ...	Do. do. ..	8583	35 2 0			
23rd August 1912 ...	Do. do. ...	9893	14 1 0			
12th December 1912 ...	Do. do. ...	14157	4 6 0			
28th January 1913 ...	To goods Messrs. Marshall Sons & Co., Bombay.	368L	51 7 0			
15th February 1913 ...	To goods Messrs. Richardson and Cruddas, Bombay.	1018	3 3 0			
19th April 1913 ...	Do. do. ...	4167	10 6 0			
May 1913 ...	Rail and other charges on tools to and from Naginhal.	...	16 13 0			
	Departmental charge for erection ...	...	80 0 0			
	Balance sent to Mr. Sangangauda Ramangauda Patel (including money order commission).	...	12 14 0			
			1,900 0 0			1,900 0 0

Invoices and bills are available for inspection in the office at any time.

From this it will be obvious that all expenditure is shown, and the balance if any returned to the owner.

Work through this Department.

By entrusting work to this Department cultivators have the following advantages :—

(1) They are credited with the trade discount; (2) I take the responsibility of designing the plant, (3) ordering the machinery, (4) erecting, (5) and testing the same, (6) and then handing it over to the owner in proper working order.

I am naturally very interested in their welfare, and I take particular pains to make the schemes successful in every way.

It is perfectly clear even to the ordinary mind, that the advantages are great, if the cultivator entrusts his work etc. to this Department.

Help given at any time.

This not only applies to new plants, but advice is given in the case of existing plants: as an instance I may just mention an incident which happened at Ahmedabad :—

The pumping plant of a cultivator there had got out of order owing to the engine being taken down, cleaned, and re-assembled by unskilled hands; I happened to be there in connection with some boring operations, and of course I went to his assistance, and was able to put the matter right in about 30 minutes.

He told me that he had been trying for two days, but without success.

This only proves that the Department is willing, and indeed anxious, to assist the cultivators in every possible way, a fact which this report should prove conclusively.

Staff.

I am pleased to be able to state that my staff will now be made permanent, and from office records to notice that Government has kindly consented to increase the staff in accordance with suggestions made by my predecessor.

Judging from the light of recent events I anticipate the introduction of new subjects, and a general expansion of the present matter now being dealt with by my Department. This will fully employ the permanent establishment and necessitate a further increase as time goes on, particulars of which will be submitted when thought absolutely necessary.

I have much pleasure in stating that Mr. Paranjpe is doing excellent work.

It is a pleasure to record that he has recently been promoted and is now my assistant. I anticipate that in a few years he will be able to take up the duties of Agricultural Engineer in other provinces.

Mr. Chitale is also doing very good work, and he has now been promoted to the post of second Mechanical Superintendent. He is both painstaking, and consistant, and will soon be a valuable member of the Department.

Mr. Pednekar is doing good work and is a useful man.

Messrs. Talegaonkar and Dugal are now becoming very useful as fitters, and will soon be quite efficient for erection work.

Clerical Staff.

Accounts and correspondence now demand expert and continuous attention, and are a most important branch of my Department, and the able, conscientious and capable way in which Mr. Joshi, my Head Clerk, has assisted me in this work, calls for the highest praise.

As the Boring, Blasting, and Ploughing sections of this Department develop, the Head Clerk's responsibility will increase in a corresponding degree.

Well Boring in Gujarat.

Boring operations in Gujarát have been carried on by the Agricultural Department for the last 5 years, and the Deputy Director of Agriculture was in charge of these operations until October 1912.

My predecessor Mr. Musto when touring in Gujarát in October last had inspected this work and afterwards made a number of suggestions which were the means of obtaining better results.

Boring in Gujarát received a great impetus from the last famine, and had attained such a magnitude, that it was thought better to place these operations under the supervision of an officer having mechanical knowledge.

The work was therefore transferred to this Department.

Mr. Musto was however reverted to the Public Works Department soon after taking charge of this branch of the work, and Mr. Thiselton-Dyer, who succeeded him, had not much time to devote to boring.

The President, District Local Board, Kaira, informed the Agricultural Engineer that his Board had sufficient number of men to take charge of the boring work then being carried on by the Agricultural Department in Kaira District, and that the Board was also willing to conduct this work and so relieve my Department of this responsibility.

Boring in Kaira consequently was given up by this Department and the headquarters of the Boring Overseer were removed to Ahmedabad.

Kaira always offered a large amount of work and the greatest number of successful bores as compared with the boring in other districts of Gujarát.

Ahmedabad now stands first as Kaira is not taken into consideration.

It is my intention to persevere in this district and ascertain by means of the new machine and present data what the possibilities of hand boring are.

The new boring machine which has been mentioned before, has now been tried in different wells and has given great satisfaction, the extent of which may be gathered from the fact that it makes a bore in a third of the time taken up by the Cawnpore sets.

This information is the result of comparative tests between the two types of machines.

The sets in Dholka were taken to Borsad and Daskroi tálukas.

During the year under report 73 wells were bored, out of which 51 were successful; 1 partially so; 6 were stopped by the owners after going to some depths, and 15 were unsuccessful.

Statement (I) gives result by tálukas and (II) by villages with depths, expenditure, etc.

The percentage of success this year is 78, while that for last year was 77; and the labour charges are higher this year by Re. 0-1-10 than they were last year.

SETS OWNED BY THE DEPARTMENT.

Fourteen sets were lent to the District Local Board, Kaira.

They have now returned the whole of these and purchased sets of their own.

One set is however lent to Broach Local Board.

I have now 27 sets at Ahmedabad, which will eventually be replaced by the new machine simply because of its speed and efficiency.

HELP RENDERED TO KAIRA DISTRICT LOCAL BOARD.

The Agricultural Engineer was requested to select a power borer for the Kaira Local Board, which he did, after taking into consideration the requirements of the Board and the local conditions where the machine was expected to work and the machine purchased was a petrol power borer from America.

This machine is doing good service, I believe, to the Board.

The average cost per foot for boring 10 feet in stiff clay being Rs. 1-2-2.

NEW RULES.

New rules are a little more on business lines than the old ones.

Nothing definitely can however be said about the results.

I however believe that agriculturists will come forward and have their wells bored under reasonable conditions when they know the success achieved by this Department.

I anticipate a great increase in the number of applications as the advantages of the new conditions are recognized.

The total expenditure incurred during the year is Rs. 10,641-13-0 and the total recoveries amount to Rs. 4,066-7-7. These are recoveries for this year only, inclusive of amounts outstanding to be recovered within a very short time.

Recoveries from the last year's expenditure amount to Rs. 5,675-3-5. The total of recoveries therefore comes to Rs. 9,741-11-0.

The total approximate net cost to Government therefore amounts to Rs. 900-2-0.

OVERSEER.

Mr. Nagindas, the Overseer in charge of Boring operations, has given every satisfaction.

W. M. SCHUTTE,
Agricultural Engineer, Bombay Presidency, Poona.

STATEMENT No. I.

Statement showing the result of boring by Tálukas.

Name of Táluka.	Successful.	Partial successful.	Un-successful.	Wells in which work stopped by the owners.	Total number of wells bored.	Percentage of success.
Kaira District.						
Borsad	12	1	2	...	15	87
Nadiád	4	...	3	1	8	57
Mehmedabad	1	...	...	...	1	100
Broach District.						
A'mod	2	...	...	...	2	100
Surat District.						
Bárdoli	1	...	1	1	3	50
Ahmedabad District.						
Dholka	8	...	3	1	12	73
Daskroi	23	...	5	3	31	82
Viramgám	...	...	1	...	1	...
Total ...	51	1	15	6	73	78

W. M. SCHUTTE,
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STATEMENT No. II.

Statement showing the number of wells bored with depth, cost, and result, etc., during the year 1912-13.

Serial No.	Number of wells.	Name of Táluka.	Name of Village.	Depth of well.	Depth of boring.	Labour charges.	Average labour rate per foot.	Water-supply before boring in koses.	Water-supply after boring in koses	Remarks as to the result.			Cost of pipes and pay and travelling allowance of Muccadams, etc.		Agency who paid for labour.	General remarks.
													Recovered and credited into Treasury.	To be recovered.		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		UNDER OLD RULES.		Ft. in.	Ft. in.	Rs. a. p.	Rs. a. p.						Rs. a. p.	Rs. a. p.		
		Kaira District.														
1	105	Borsad	Khanpur	62 6	92 0	54 3 0		½	3½	Successful.	...	...	75 6 4	.....	Owner	Well was bored in 1911 but water was flowing slowly and have taken in hand again.
2	123	Do.	Sunav	69 0	72 0	121 14 0		1½	5½	Do.	...	...	79 6 7	.....	Do.	
3	129	Do.	Do.	48 0	112 0	85 7 9		Nominal	2	Do.	...	...	88 14 1	.....	Do.	
4	130	Do.	Khanpur	58 0	77 0	30 10 6		½	4½	Do.	...	...	39 8 1	.....	Do.	
5	131	Nadiad	Vadthal	38 0	50 0	31 12 0		1	2	Do.	...	...	44 15 1	.....	Do.	
6	132	Do.	Narsanda	51 6	115 0	96 2 6		...	...	.....	Unsuccessful.	...	.....	.....	Do.	
7	133	Borsad	Sunav	51 0	140 0	149 10 0		...	...	.....	Do.	...	.....	.....	Do.	
8	134	Nadiad	Vadthal	49 0	79 0	53 14 0		...	...	Owner desired to stop the work.			.....	.....	Do.	
9	135	Borsad	Khanpur	55 0	90 0	38 5 0		¾	4½	Successful.	...	...	68 5 9	.....	Do.	Water level rose two feet higher. Boring water is sweet while old was slightly brackish.
10	62	Do.	Saijpur	59 6	82 6	42 7 0		½	4½	Do.	...	...	21 10 8	.....	Do.	Water level rose one foot higher. This well was bored in 1910 but owing to little water taken in hand again.
11	136	Do.	Khanpur	57 0	90 0	42 9 0		½	2½	Do.	...	...	9 1 5	.....	Do.	
12	137	Nadiad	Vadthal	47 0	122 0	108 12 6		...	...	.....	Unsuccessful.	...	.....	.....	Do.	
13	138	Borsad	Saijpur	52 9	96 0	60 7 6		¼	3¼	Successful.	...	...	.....	74 14 5	Do.	
14	120	Do.	Pandoli	49 0	85 0	140 14 0		...	...	.....	Unsuccessful.	...	.....	.....	Do.	Four inches set.
15	139	Do.	Khanpur	60 0	95 0	100 6 0		½	1½	Successful.	...	...	91 15 11	.....	Do.	
16	140	Do.	Saijpur	66 0	102 0 88 0	81 13 0		¼	2¼	Do.	...	...	.....	77 4 11	Do.	
17	141	Do.	Porda	54 0	116 0	99 2 0		...	...	Partially successful.	...	...	.....	94 2 10	Do.	Water was flowing slowly due to rise of sand, but the owner desired to keep the pipes. He will clear the whole afterwards.
18	142	Nadiad	Saloou	61 0	100 0	126 10 9		...	...	.....	Unsuccessful.	...	.....	.....	Do.	
19	143	Do.	Khadol	70 0	30 0	14 12 0	1 2	½	2½	Successful.	...	...	28 14 3	.....	Do.	
20	144	Borsad	Saijpur	61 0	90 0	65 4 0	1	1	5	Do.	...	...	74 2 6	.....	Do.	
21	145	Do.	Khanpur	59 0	100 0	135 3 6		1	5	Do.	...	...	101 11 2	.....	Do.	Old water was brackish while boring water is sweet.
22	146	Nadiad	Khadol	51 0	56 0	10 0 0		¾	1¼	Do.	...	...	44 9 11	.....	Do.	
23	147	Do.	Do.	51 0	48 0	19 12 0		½	1¼	Do.	...	...	41 5 3	.....	Do.	Old water was slightly brackish while boring water is sweet.
24	48	Mehmedabad.	Kanij	37 0	68 0 109 0	118 6 0		¼	2¼	Do.	...	...	144 5 3	.....	Do.	Do. do.
		Broach District.														
25	4	Amod	Amod	27 6	112 0	179 2 0		1	5	Do.	...	...	.....	67 15 0	Do.	Water is slightly brackish.
26	5	Do.	Ajawnagar	40 0	118 0	313 2 0		Nominal	...	Do.	...	...	.....	124 5 3	Do.	Boring water is sweet. Well shall have to be deepened to remove top pipe when water will flow as there is nominal water in the well. Water of the well is brackish.
		Surat District.														
27	16	Bardoli	Pooni	44 0	67 0	36 0 0		½	1½	Do.	...	...	54 11 11	.....	Do.	
28	1	Do.	Do.	45 0	116 0	187 12 0		...	...	.....	Unsuccessful.	...	.....	.....	Do.	
		Ahmedabad District.														
29	7	Dholka	Jakhada	21 0	148 0	328 4 6		...	...	.....	Do.	...	.....	.....	Local Board.	Water met with was brackish.
30	9	Do.	Utetir	19 0	97 0 113 0	362 7 6		...	...	.....	Do.	...	.....	.....	Do.	Do. do.
31	11	Do.	Kalyanghad.	19 0	114 0	170 9 6		...	...	Successful.	...	...	112 0 7	.....	Do.	Water is slightly brackish. Well shall have to be deepened to remove one pipe to allow water to flow into the well. Boring is done, in a 5" pipe driven 38 feet by the Public Works Department.
32	12	Do.	Suinj	32 0	98 0	111 15 0		...	...	Do.	...	...	86 14 7½	.....	Do.	Boring water is sweet while old was slightly brackish. Flow could not be tested by kossas due to monsoon.
		Carried over		...	...	...	...	...	...	...	...	...	...	...		

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STATEMENT No. II—*continued.*

Serial No.	Number of wells.	Name of Táluka.	Name of village.	Depth of well.	Depth of boring.	Labour charges.	Average labour rate per foot.	Water-supply before boring in koses.	Water-supply after boring in koses.	Remarks as to the result.			Cost of pipes and pay and travelling allowance of Muccadams, etc.		Agency who paid for labour.	General remarks.
													Recovered and credited into Treasury.	To be recovered.		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		UNDER OLD RULES—*continued.* *Ahmedabad District*—contd. Brought forward ...		Ft. in. ...	Ft. in ...	Rs. a. p. ...	Rs. a. p. ...	...	...				Rs. a. p.	.....		
33	13	Dholka ...	Kanka ...	26 6	93 0	137 4 0		...	...	Successful.	...	...	89 12 1½	.....	Local Board.	Well shall have to be deepened to remove one pipe as there is only 1 foot 6 inches of water.
34	14	Do. ...	Vasna ...	27 0	37 0	56 15 0		...	...	.....	Unsuccessful.	...	.....	.....	Do.	
35	15	Do. ...	Khanpur ...	27 9	51 0	32 12 0		...	...	Work	was stopped by	the owner.	.....		Owner.	
36	16	Do. ...	Dholka ...	36 0	115 0	222 2 0		2	4	Successful.	...	...	119 14 8	10 0 0	Do. ...	Boring water is sweet. Old was brackish.
37	17	Do. ...	Do. ...	32 6	42 0 54 0	187 4 0		4	10	Do. ..	...	...	161 12 4	.....	Do. ...	4 inches set. Well has an oil engine and pump.
38	18	Do. ...	Do. ...	48 6	82 0	82 15 0		¼	4½	Do. ...	...	...	69 4 9	.....	Do. ...	Boring water is sweet while old was brackish.
39	17	Viramgaum. Potri ...		38 0	170 0 2nd hole.	253 15 0		...	...	.....	Unsuccessful.	...	.....	.....	Potri State.	
40	27	Daskroi ...	Vastral ...	53 0	97 0	198 9 0		...	...	.....	Do. ...	...	.....	104 10 4	Owner ...	4 inches set.
41	37	Do. ...	Sahavadi...	20 0	56 0	61 4 0		½	1½	Successful.	...	...	58 15 9	.....	Do.	
42	38	Do. ...	Vinzol ...	35 0	55 0	55 5 6		½	2	Do. ..	...	...	.....	50 7 4	Do.	
43	39	Do. ...	Kubadthal.	66	72 0	79 8 0		½	3½	Do. ...	...	...	70 10 11	.....	Do. ..	Water level rose 3 feet 6 inches higher.
44	40	Do. ...	Vinzol ...	34 0	84 0	84 8 3		Nominal.	1	Do. ...	...	...	.....	69 3 8	Do.	
45	41	Do. ...	Vasai ...	35 0	40 0	28 0 0		¼	10	Do. ...	...	...	40 12 0	.....	Do.	
46	42	Do. ...	Gamdi ...	34 6	56 0	52 0 0		¾	2¼	Do. ...	...	...	.....	47 1 5	Do.	
47	43	Do. ...	Kubadthal.	37 0	115 0	100 2 0		¼	3½	Do. ...	...	...	.....	94 3 5	Do. ...	Water level rose 6 feet higher.
48	44	Do. ...	Kasandra .	35 0	103 0	121 15 0		...	...	.....	Unsuccessful.	...	.....	.....	Do.	
49	45	Do. ...	Vinzol ...	51 0	47 0	13 10 0		¾	4½	Successful.	...	...	.....	46 1 2	Do. ...	Water level rose 3 feet higher.
50	46	Do. ...	Lambha ...	30 0	28 0	32 4 0		¼	1½	Do. ...	...	...	27 4 2	.....	Do. ..	Boring water is sweet while old was slightly brackish.
51	47	Do. ...	Gamdi ...	27 0	85 0	117 7 0		...	...	.....	Unsuccessful.	...	.....	.....	Do.	
52	48	Do. ...	Vinzol ...	45 0	59 0	53 12 0		Nominal.	1	Successful.	...	...	.....	52 14 8	Do.	
53	49	Do. ...	Lambha ...	39 0	81 0	65 1 0	1 1 2	1	3	Do. ...	...	...	64 5 9	.....	Do.	
54	50	Do. ...	Zonce ..	50 0	53 0	20 4 0		¼	2¼	Do. ...	...	...	41 8 3	.....	Do.	
55	51	Do. ...	Kuba ...	37 6	145 0	228 1 0		¼	1½	Do. ..	...	...	.....	143 8 4	Do. ...	Boring water is sweet while old was brackish.
56	52	Do. ...	Zonce ...	48 0	45 0	16 14 0		¼	3½	Do. ...	...	...	.....	36 12 3	Do. ...	Water level rose 7 feet 6 inches higher.
57	53	Do. ...	Lambha ...	58 0	53 0 54 0	92 10 0		1	5	Do. ...	...	...	54 1 1	.....	Do. ..	Boring water is sweet. Old was brackish.
58	54	Do. ...	Gatrad ...	32 0	80 0	84 5 0		...	...	Work	was stopped by	the owner.	.....		Do.	
59	55	Do. ...	Kubadthal.	49 0	84 0	93 3 0		...	...	.....	Unsuccessful.	...	.....	.....	Do.	
60	56	Do. ...	Aslali ...	36 0	84 0	27 5 6		¼	3½	Successful.	...	...	65 10 2	.....	Do.	
61	57	Do. ...	Zonce ...	45 6	68 0	58 14 0		¼	3½	Do. ...	...	...	.....	57 1 3	Do. ...	Water level rose 6 feet higher.
		UNDER NEW RULES. *Surat District.*														
62	2	Bardoli ...	Ambheli ...	45 0	60 0	26 7 0		...	...	Work	was stopped by	the owner.		20 11 1	Do.	
		Ahmedabad District.														
63	1	Daskroi ...	Aslali ...	65 0	95 0	50 2 0		...	...	.....	...	...	89 1 10	.....	Do.	
64	2	Do. ...	Zonce ...	45 0	48 0	17 0 0		½	3½	Work	was stopped by	the owner.	.....	56 1 7	Do. ...	Water level rose 5 feet higher.
65	3	Do. ...	Do. ...	42 0	50 0	37 5 0		¼	1½	Successful.	...	...	.....	55 14 10	Do. ...	Water rose 1 foot higher.
66	4	Do. ...	Aslali ...	34 9	75 0	100 5 6		...	...	Do. ...	...	...	.....	45 11 10	Do.	
67	5	Do. ...	Sekhpur Khanpur.	35 0	123 0	221 4 0		...	...	.....	Unsuccessful.	...	.....	119 8 8	Do.	
68	6	Dholka ...	Dholka ...	42 0	26 0 40 0	31 12 0		1	5	Work	was stopped by	the owner.			Do.	
69	7	Daskroi ...	Zonce ...	40 0	81 0	76 8 0		¼	2¼	Successful.	2nd hole unsuccessful.	...	65 11 10	.....	Do.	
70	8	Do. ...	Narol ...	28 0	50 0	27 6 0		2	10	Do. ...	...	...	.....	89 2 3	Do.	
71	9	Dholka ...	Dholka ...	41 0	34 0	15 9 0		½	1½	Do. ...	...	...	10 0 0	73 2 8	Do. ...	4 inches set. Well has an oil engine and a pump.
72	10	Daskroi ...	Narol ...	44 0	49 0	41 12 0		1	3	Do. ...	...	...	36 6 10	.....	Do. ...	Boring water is sweet, old was brackish.
73	11	Do. ...	Kubadthal.	Due to monsoon is left for				the present.		.....	...	...	.....	91 1 0	Do. ...	4 inches set.
74	12	Do. ...	Bhat ...	35 0	6 0 40 0	44 2 0		1	2¼	Successful.	...	...	.....	.....	Do.	
				...	6,398 6	6,855 4 3	1 1 2						2,354 3 10	1,801 3 9		

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